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PLANTS & GARDENS

Gardening Under Artificial Light

Ideas for
Indoor Gardens
Under Lights

Questions and
Answers on
Indoor Light
Gardening

Sources of
Electric Light
for Plants

The Basement
Greenhouse

Plant Response
to Light

Plant Propagation
Under Lights

SPRING
1970

NEW SERIES



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For a list of topics see back cover.



Roche

Fluorescent light fixtures may be installed within a book shelf for decorative and functional results, as shown here in this arrangement of begonias and African-violets.

BROOKLYN BOTANIC GARDEN

Man has made a tool of light. Once, there was only light from the sun and moon for the farmer to manipulate and the poet and song writer to contemplate. As our civilization progressed, so did the need for more light. In the field of horticulture, which owes its very existence to the sun—as indeed does man himself—another source of light to supplement or substitute for that from the sun was sought. For the sun does not shine everywhere for 24 hours and its rays fail to penetrate solid walls. It can not be turned on and off at the flick of a switch. Nor is the heat which accompanies sunlight always desirable. Along with man's success in discovering other sources of energy-giving light have come air pollutants which in turn dilute the quality and quantity of available sunlight. Nor can the sun be suspended over a tray of African-violets on the living room's book shelves.

There is a long history of man's attempts to understand and control light. Theory and fundamental truths were plentiful, but until recently, application of research findings had been an expensive toy for a skilled few. Today, knowledge as well as practical experience in the use of artificial light has increased to such a degree that a whole new adventure in horticulture has resulted.

The uses of artificial light are of significance for home gardeners, scientists and commercial growers, and there is hardly any aspect of horticulture that can not benefit from some application of present-day knowledge on the subject. Guest Editor R. Milton Carleton has assembled articles for this Handbook which give the background of plants' needs for light along with practical applications and techniques. We hope the Handbook will become a handy, finger-tip source of information for all gardeners—whether growing plants under artificial light is a new experience or one which they are already enjoying.



Director

THE BASEMENT GREENHOUSE COMES OF AGE

A quarter-of-a-century's experience suggests varied possibilities for plant culture and propagation under lights

R. Milton Carleton

I BEGAN GROWING PLANTS under lights during World War II, using early types of fluorescent tubes then available. At the time, I was trying out the pioneering ideas developed by Dr. Vernon T. Stoutemyer at the Glenn Dale Plant Introduction Station of the Department of Agriculture. Since Dr. Stoutemyer had used a closed unit, I decided on the same type of structure and enlisted the help of a friend, who was equipped to bend Masonite hardboard into various shapes. Between us, we made a device that resembled nothing so much as a coffin, with a domed top, in which we mounted four 40-watt fluorescent tubes. They were the blue-white type and were soon found to be too low in red radiation for good growth. Incandescent bulbs were added to fill this need. Four sockets were mounted between the two central tubes, evenly spaced, and a 15-watt bulb screwed into each.

The combined sources gave light which, for that day, produced quite remarkable results. Our one problem was heat, which we managed to vent out of the unit with a Rube Goldberg device of a small fan inside a 6-inch fiber tube. Another reduction in heat resulted when the ballasts were mounted on top of the unit instead of inside atop the tubes.

I was fortunate in having discovered the value of vermiculite as a rooting and growing material as early as 1937. A local outlet supplied me with all the fine-sized particles I could use (simply waste from the production of wall-fill insulation). The one problem in its use was that it had to be watered with extreme care to avoid saturation, which would drive out air. Later, the solid bottom of the unit

was replaced with bronze screening—a piece of an old Fourdrinier wire from a paper mill—which allowed excess water to drain off and also aerated the too-fine vermiculite.

Later, I developed a growing mixture which I use to this day and which I find overcomes many of the problems of other growing media used under lights. It contains two materials. The first is sphagnum peat moss, a particular type which must be fairly coarse and not like the finely sifted grade so often sold in small bags for house plant use. The second material is calcined clay sold for use in aerating golf greens and tees. Although it is not readily available in this form, the same product is packaged and sold in chain stores, hardware stores and pet shops as cat litter. Not every brand of pet litter will do, however. Some products turn to a slimy paste when moistened. Try a sample before mixing with peat moss. A 50-50 mixture of these two materials, by volume, not by weight, will give a growing medium which is almost impossible to over-water, which allows excess fertilizer solutions to drain off readily and which remains moist while allowing all the air needed for good root action.

Trays filled with the rooting medium (vermiculite in my first tests) were placed so that the tops of plants, cuttings or seedlings were about 3 inches from the light tubes. Later, the top of the unit was suspended on ropes and pulleys, with counter-weights, so it could be moved up and down as plants were changed. Light-meter readings showed about 300 foot-candles, only a rough guide, since plants do not "see" light in the same way as the human eye or the camera.

(Continued)



Sylvania Lighting Center

A section of basement can be converted into a home greenhouse when plant benches and a system of fluorescent light fixtures—to take the place of the missing sunlight—are installed. The area can be a place to grow exotic as well as more ordinary plants which can then be used for temporary display in other sections of the house. Cuttings can be rooted, bulbs forced, and seedlings started for transplanting outdoors in the spring.

At first, I was timid in what I grew, limiting my efforts largely to rooting cuttings. During those early days, I had an opportunity to prove the reliability of Stoutemyer ideas when I had to leave unexpectedly on a three-week trip to visit horticultural research centers. With the unit crammed with 300 cuttings of *Euonymus fortunei* 'Coloratus' (bronze-leaf winter creeper) I hated to leave. I soaked the vermiculite as much as I dared, including a weak dose of fertilizer in case roots would grow enough to absorb it. I closed the lid and turned on the lights.

This was before I had an automatic time clock and as I did not want to impose on marital labor, I left the lights on 24 hours a day for three weeks. On my return, I found practically every cutting rooted and in vigorous growth. A smaller batch of cuttings of yews and another of American arborvitae had also rooted. The arborvitae terminal tips had grown half an inch.

I began gradually to grow more and more species of plants. Early successes were largely with shade-tolerant plants. Tuberous begonias from seed were among the most spectacular in successful results. They were started in November under an 18-hour day, the seedlings transplanted into 2-inch pots, and shifted gradually until they were in 4-inch pots by spring, with flower buds already set. I could produce as many plants for bedding-out on Memorial Day as space would allow.

At the time, fuchsias in improved forms were just becoming popular in California. Because of the limited height available in the propagating unit, cuttings could not be grown to maturity, but buds formed freely. *Impatiens sultanii* was another success. At the time, only cuttings of the common harsh red variety were available but from seed I raised hundreds of plants ranging from pale pink to deep purplish-maroon. The pure white variety, which refused to grow at all in greenhouse benches, was more difficult, but enough plants were produced to develop an extensive group under the shade of maples out-of-doors.

African-violets from seed and from

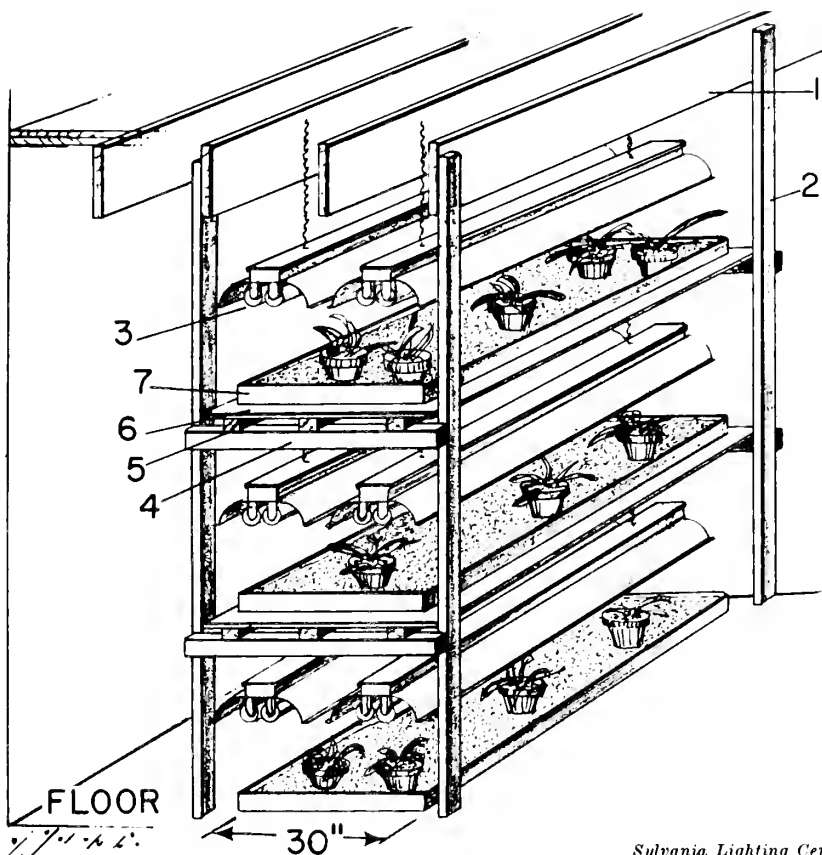
cuttings proved to be moderately successful, but I was unable to produce really top-quality plants until I could increase light intensity to 600 foot-candles with a combination of one standard Gro-Lux tube to one Wide-Spectrum Gro-Lux. Best growth was with 18 hours of light. At 24 hours, plants stopped flowering, as they did on any day length shorter than 16 hours.

Coleus, with its bright colored foliage, grew so readily that I had to reluctantly discard cuttings that would have been a credit to any garden. *Exacum affine*, the so-called German-violet, responded in a most peculiar way. Under 18 to 24 hours of light, it remained so dwarf the seedlings were all but impossible to handle, even at the age of three months. At 15 hours, growth and bloom were normal.

As already mentioned, heat proved a problem. An old rule for successful plant growth calls for a balance between four elements—light, heat, water and food. If any one of these factors is increased or decreased, the others must be proportionately altered. When I could supply only 300 foot-candles (for a weakness in rating by foot-candles, see page 25) I found it difficult to get good growth at any reading higher than 65°F. This meant that practically no growth was possible during summer months, even in a cool cellar. However, the use of a stream of forced air helped somewhat, apparently because of the cooling and drying effect of air on the leaves.

As experience was gained, more and more species were tried. My most conspicuous failure was with lettuce: it proved difficult to provide the right light-to-temperature ratio. Many bulbs proved to be surprisingly easy. Even today, I wonder why growers bother to use greenhouse bench space to force tulips and hyacinths when they can be forced readily on shelves under lights in a cellar where heating would be practically no problem. Good rooting in a dark cellar at about 38 to 40°F is all that is needed to prepare them for forcing under lights.

Half-hard cuttings of deciduous shrubs are among the most satisfactory plants to



Sylvania Lighting Center

PLAN FOR BASEMENT LIGHT GARDEN

Cross-sectional sketch of a plant growth area as developed in a basement. Plant growing areas are tiered three-high. Each section is 4 feet long and illuminated by 4-foot fluorescent tubes in reflector fixtures, 2 tubes per fixture. Construction consists of H-type frames resting on the floor and attached to the joists (No. 1) Uprights (No. 2) are 2 x 4's; cross bars (No. 4) are also 2 x 4's. Longitudinal supports (No. 5) are made of 2 x 2's on which rest $\frac{3}{4}$ -inch plywood platforms (No. 6). (Note. Plywood should be exterior type.) Metal trays (No. 7), with turned up sides and filled with gravel, rest on the plywood platforms and serve as the actual method of supporting the plants. Such units can be attached end-to-end in a series. Fixtures with lamps hang on chains for height adjustment. Fixture reflectors (No. 3) are 12 inches wide. The width of the bed is about 30 inches.

start under lights. Because moisture is maintained at a high rate in a closed chamber, larger branches can be rooted than in the open house bench. This can often save time in producing a finished shrub of a given size. The only danger is the temptation to fill the entire home landscape with shrubs, leaving no room for annuals or perennials! When rooting cuttings from shrubs, I prefer to use only Wide-Spectrum Gro-Lux tubes, omitting the incandescents which were formerly needed to supply red energy.

Open Bench Propagation

For open bench propagation, a combination of daylight tubes with about 60 watts of incandescent light added for every 80 watts of fluorescent is preferred by many. If the tubes are spaced 6 to 8 inches apart, a line of sockets can be run between them, a foot apart. When four such sockets are used with two 40-watt tubes, 15-watt incandescents can be used. This distributes the red-emitting incandescent light more uniformly.

One weakness of open-bench propagation is the difficulty of maintaining humidity. A technique recommended to me by Roy Hay of England, one of the great plantmen of a country where there are many able gardeners, is useful in overcoming dry air. He sprays cuttings with an anti-dessicant latex similar to the product Wilt-Pruf which is sold in this country. Its use does not seem to interfere with rooting in any way.

Although I was one of the early users of rooting hormones, my experience with them under lights has been mixed, at least when they are used under the same methods as in the greenhouse. I find that it is better if the cuttings are exposed on a bench or table for an hour or two before dipping into a hormone powder. Apparently, when the ends of the cuttings are dry, much less powder is picked up, enough to stimulate rooting yet without over-treating.

Seedlings Under Lights

Seedlings of plants which grow normally in full sunshine can be produced under

lights, but growing them to the flowering stage presents problems which most amateurs are unable to overcome. Transplants of annual bedding plants as well as such vegetables as tomato, cabbage, pepper and others ordinarily started from seed indoors are easy to grow to the two- or three-leaf stage, at which time they should be moved outdoors. They, however, will be too succulent and tender to move directly into the open garden. To harden them for the final move, hold them in a shaded coldframe, or on a porch out of direct sun for three or four days. To be on the safe side, light shade emitted from a shingle might be used on important plants.

If facilities for hardening-off are not available, I have successfully used the anti-dessicant spray mentioned above. A diluted spray, mixed with water in the amount recommended on the bottle or package, should be applied.

When feeding plants which grow in an enclosed unit under lights, I have tried a number of different fertilizers, including some highly complex formulae which only a competent chemist can mix. None of these has proved better than almost any well-balanced liquid house-plant fertilizer. In my experience with the use of the peat and calcined clay mixture, I find I can apply fertilizer at one-fourth the rate recommended by the manufacturer, but instead of waiting fairly long intervals, I add it every time I water. Since watering is not as frequent—and because the artificial soil mixture does drain freely—I have rarely seen any signs of over-fertilization. Incidentally, the pH of the peat-calcined-clay mixture is generally about neutral (pH7).

An odd fact about growing plants under lights is that insects practically never attack. Two exceptions are white fly and aphids. Aphids are easy to kill with an aerosol bomb, but white flies are tough. However, Malathion, used two or three times, will usually clean up an infestation. If only ornamentals are being grown, I have used a systemic insecticide, which usually gets rid of this pest for weeks. ♦

20 QUESTIONS AND ANSWERS ON INDOOR GARDENING UNDER LIGHTS

*How to begin gardening indoors with
a simple or elaborate fluorescent unit . . .*

1. *Where can I put my indoor light garden?*

Under cabinets in the kitchen; in bookcases; on the floor under windows; on tables; in room dividers; in the cellar; attic or garage.

2. *Are light gardens expensive?*

Workable units can be bought for as little as \$10.00. A commercial unit of two tubes, 24 inches long, with a white-painted reflector, costs about \$10.00. There are prefabricated installations in various sizes. A person handy with tools can build his own unit.

3. *What controls the size of a light garden?*

Length is controlled by the size of fluorescent tubes. Height is increased by using a number of tiers or shelves. The width is a matter of the number of tubes which are set side-by-side. Typical lengths of fluorescent tubes are 24, 36, 48, 72 or 96 inches.

4. *What is the best length of fluorescent tube to use?*

The longest possible because there is a loss of intensity at both ends.

5. *What is the effective growing space under the tube?*

The length of the tube, the width of the tube itself, and 3 inches on each side. To increase light intensity, the tubes must not be crowded together. (See page 26.)

6. *How far away can the light be from the plants?*

For some foliage plants, ceiling-level

lights, as exist in offices, are sufficient. For flowering plants, the lights must be suspended no more than 15 inches (but 8 inches is much better) above them as light intensity declines rapidly at increased distances from the tubes. Radiant energy from the tubes is not nearly as strong as sunlight. Compensation for the low intensity of the tubes is made by leaving them on longer than a normal sunny day. Sixteen hours of lighting is usual. Also, there are no cloudy days!

7. *What are the best tubes for light gardening?*

Daylight or natural, among the commercial tubes. Specially formulated tubes, such as Wide Spectrum Gro-Lux, Natureseent, Plant Gro, are manufactured especially for plant growing.

8. *What other equipment is needed?*

The fluorescent fixture, a long narrow box containing the ballast from which the sockets protrude downward. A timer and reflectors.

9. *Is one fixture required for each tube?*

Fixtures can be bought which take one, two, three, or four tubes, as can be observed in commercial ceiling installations.

10. *Are all fluorescent tubes straight?*

There are circle-line tubes which are available in a number of sizes. General Electric makes an 80-watt panel light, which is square.

11. *Are incandescent bulbs used?*

Yes, principally to augment fluorescent lights, as they are strong in the red part of the spectrum. They are usually set between the fluorescent tubes. Between two 40-watt tubes, one can set two 40-watt

Adapted with permission from a leaflet published by the Metropolitan Chapter of the Indoor Light Gardening Society of America, Inc.

incandescents. The heat output of incandescents is excessive. Buy 130-volt bulbs from electrical supply stores. They are cooler.

12. Why do I need a timer?

This is a clock which will turn the lights on and off at specified hours to control the length of day. It is plugged into a wall socket at one end and the electrical contact of the fixture at the other.

13. Why are reflectors important?

The tubes are more efficient if backed by a reflective surface. This can be a painted shelf surface or a reflector which fits over the fixture. Reflectors prevent the dissipation of light.

14. What is the simplest light garden?

It consists of a one- or two-tube fluorescent unit attached to the underside of a kitchen cabinet or shelf and a plastic tray, partly filled with pebbles. Potted plants can be set on the pebbles. Plastic crate can be used in place of the pebbles. It is plastic about $\frac{1}{2}$ inch thick, molded in a honeycomb design and used for fluorescent light diffusion. It can be cut to any size.

15. How can I increase the size of my garden?

Use longer tubes or more of them set side-by-side. Or have several lighted shelves one on top of the other. Or have an open garden in module trays on the floor of the living room. Or build benches in the cellar with lights suspended over them.

16. Are there table-top installations?

There are a number of models containing two tubes, 24 or 48 inches long, and a reflector. The light fixture is attached to standards at either end to permit adjustment in height. The outside of the reflector can be painted any desired color to complement the unit or location.

17. What other standing equipment is available?

There are 48-inch glass boxes which are provided with lights, trays, and sliding panes. Four legs lift them off the floor. The lights are below eye level to prevent glare. A fish tank with a light unit set on top can also be used. Fruit-ripening bowls, which are now on the market, are large enough to contain a potted plant or



Jack Golding of Kearny, New Jersey, has transformed his basement into an indoor garden by installing fluorescent lights. His begonias grow in the boiler room.

two. There are other free-standing, multi-tiered metal stands, some equipped with casters to provide mobility.

18. *What special equipment is required by the elaborate units?*

A small fan to keep air circulating and a humidifier are both recommended for large light gardens which are open rather than enclosed by glass. The humidifier can be placed at one end of the garden and the fan at the other end. The reservoir capacity of most small floor-model humidifiers is from 2 to 10 gallons of water.

19. *How can I build my own unit?*

A simple case can be constructed to fit into the space available, such as under a window. Make it of plywood finished with wood or formica. Frame the front side with a broad band of wood, stained or painted, to hide the plant trays and shield the lights. The unit can be open or, for better control of humidity, enclosed with glass (use two panes in channels, which permit the panes to slide aside). For wall units, purchase metal shelving, the lighter the better. It is available in many sizes

and is inexpensive. The outsides can be painted to match the room's color and the undersides of the shelves can be painted flat white for reflection. Holes can be drilled in the metal from which to suspend the lamps. The light fixtures can be kept adjustable by pulleys or counterweights. Most shelving has provision for adjustment of height without much trouble. A unit which is 72 inches by 72 inches by 72 inches, with three shelves of lights, can be built for approximately \$135.00, including a timer, wiring, and plugs. The cost of a humidifier is not included.

20. *What plants can be grown in such an indoor garden under lights?*

Most kinds of tropical foliage plants which do not grow over a foot or so; and such flowering plants as are found in the gesneriad family—African-violet, gloxinia, and other relatives—many orchids, bromeliads, miniature geraniums, and begonias, especially wax begonias. There are many others, including some plants we think of as garden annuals, such as the coleus. ♦



Photographs by Jack Golding

The center of Mr. Golding's cellar is devoted to propagation. All the light fixtures are suspended by chains so they can be adjusted to fit the heights of plants.

A report on important advances toward understanding the function of light in a plant's life . . .

THE EFFECTS OF LIGHT ON GREEN PLANTS

V. T. Stoutemyer

LIGHT coming from the sun is the ultimate basis of all plant and animal life on earth. All animals, including man, depend on plants at some point in their food cycle. In addition to fixation of radiant energy in the form of usable plant food-for-growth, light also controls a number of important regulatory and developmental processes in plants and animals.

Phototropism and Auxins

The tips of actively growing plant stems turn and grow toward the light source. This response depends on the distribution of a plant growth hormone (auxin) within the plant. The biological identification and later chemical isolation of the first known plant hormone opened a whole new field of plant physiology

which has had a great many practical applications.

Charles Darwin, whose name is associated with development of the theory of evolution, together with his son Francis, around 1880 showed that the tip of the leaf sheath of a grass seedling was the light receptive portion involved in the bending toward light. They showed that when the tip was removed, the response did not take place.

Around 1910 several European plant physiologists repeated and amplified these experiments using the seed leaf of the oats plant, which is still used as an important test object. Around this time it was concluded that the light response was due to an *unknown chemical substance* which was transported down the back side of the seedleaf. By 1928, the two Wents,



A familiar sight in partially shaded gardens is that of plants "bending toward light"—here illustrated by a day-lily.



Marjorie J. Dietz

This planting of flowering tobacco (*Nicotiana*) is effective on cloudy days or toward sunset. The nicotiana is a plant whose flowers normally open only in weak light.

father and son, at the University of Utrecht in Holland, developed techniques for isolating and characterizing the *unknown substance*. Shortly thereafter their associates identified it as *indoleacetic acid*. The bending of growing tips of plants toward light was now shown to be the result of a redistribution of the hormone, *i.e.*, a greater concentration accumulated in the shaded side of the growing tips and thus caused "bending toward light." Various analogous compounds of synthetic origin, such as naphthalene acetic acid, indolebutyric acid and various chlorinated phenoxy acids were soon found to produce similar responses.

Immediately, a great many practical agricultural uses for some of these compounds were developed, including the speeding of rooting of cuttings, improved fruit setting, and prevention of the premature dropping of certain fruits. Cer-

tain compounds were discovered to reduce or prevent fruit set. Some, particularly the phenoxy acids, were remarkably effective weed killers and defoliants. The defoliation of forests as a military operation has been carried out by compounds of this type.

The total volume of the numerous growth-regulating chemicals now being manufactured is impressive, as is the fact that the industry has resulted from a series of modest investigations on a highly theoretical subject: the nature of the response of plants. Now a number of other classes of plant growth substances are known, including gibberellins and kinins. Possibly ethylene should be considered with these groups. Production of abscisic acid which causes dormancy in buds of woody plants is regulated by day length. Unquestionably, experimentation with these newer groups of growth regu-

lators was first stimulated by results of research on the auxins.

Etiolation

When plants develop in the absence of light, the stems or sometimes the leaves are greatly elongated and the green chlorophyll does not develop. Tissues are soft, succulent, and without pigment. Dry weight of the tissues is usually reduced. This response to darkness is called *etiolation* ("stretching" or "legginess") and reasons for the various observed changes are not fully known. Probably changes in hormones within the plant are involved.

Vegetables such as celery, endive or witloof chicory are often blanched by mounding earth or by other means of excluding the light.

Some highly effective plant propagation procedures involve etiolation. Mound layering is an illustration, and certain fruit tree understocks are sometimes propagated in this way. Cuttings of difficult plants often root easily following etiolation treatments. Effects are quite localized and only the portion of the stem where roots are desired needs to be etiolated.

Miscellaneous Movements Related to Light

Opening and closing of some flowers are *photonastic* movements which depend on the level of illumination. The dandelion is an example of a flower which opens only on bright sunny days. Some flowers open only in weak light. Four o'clock and nicotiana are examples of flowers which open when the light diminishes toward the close of the day.

Phototaxies are also known in which the whole organism is oriented by light. These responses are found in single-celled algae or in some kinds of plant reproductive cells.

Photosynthesis

The process by which plants capture energy of sunlight and thereby form compounds is called photosynthesis. (See page 19 for an accompanying article on this subject.)

Only about 1 per cent of the total light

energy falling on a plant is actually used in photosynthesis, yet this small portion of the radiant energy falling on the earth is responsible for all life. We must not forget the role of light on the microscopic organisms or plankton of the ocean which start the food chain for many higher marine organisms. Some scientists are beginning to worry that the activities of man may eventually pollute the oceans sufficiently so that plankton cannot function. Tidal marshes also have an important role in the food chain.

The Importance of Fluorescent Light

Naturally, the introduction of fluorescent lamps had significance for the growing of plants. Fluorescent tubes are highly efficient in the amount of light produced from a given amount of electricity. After 1940, they were produced in a wide variety of spectral emissions and could match fairly well either the blue or the red absorption peaks of chlorophyll, but not both.

Years ago, I believe I was the first to report that fluorescent lamps, placed in closed glass cases or in dark basement rooms over propagating benches, often gave excellent results in the rooting of cuttings or in bench grafting. The intensities generally used then were not high enough for successful growing of plants except for a few species, such as African-violets, which were then often grown under such equipment by amateurs. The ability of cuttings or plants grown in this manner to go for long periods with very little attention is attractive to the gardener.

Growing of large decorative plants for interior design, both in dwellings and in commercial buildings, has become increasingly important. Flowering plants usually require more light than foliage plants and are less used than foliage plants, most of which are native in the dense shade of tropical forests. Frequently, locations of these plants are such that they do not receive sufficient light. In

Margaret C. Perry

Opposite: Foliage house plants thrive under fluorescent light in a mid-city office.





Many foliage plants respond favorably to incandescent light. This collection of five pothos plants has been growing under a 100-watt bulb, which is turned on each evening, for three years.

America, living-room temperatures tend to be well above 70°F which increases the problem since plants at higher temperatures need more light.

Plants in interior planters should be replaced or rotated regularly and some commercial florist firms supply the plants on this basis by rental. Supplemental artificial light has been found to be highly effective in prolonging the life and health of interior decorative plants and can even serve as the sole light source if given from 12 to 16 hours per day at a level of 300 to 500 foot-candles. Quite beneficial effects on some plants can be obtained with as little as 20 or 30 foot-candles. Fluorescent lamps are ordinarily used and can be placed so that they are close to the plants and also contribute to the room illumination.

In some parts of the country, light is a limiting factor in the production of glasshouse crops at certain seasons of the year. Some experimentation has been done with the increase of light by placing foil reflectors within the glasshouse and by the use of fluorescent lamps. Substantial increases have been measured with such crops as carnations. Increases of as little as 30 foot-candles over a 12-hour lighting period have produced substantial crop increases, particularly early in the season. Future commercial use of this development will depend on the economic factors involved, since the cost of electricity varies greatly in different regions.

Photoperiodism

One of the great landmarks of plant science was the announcement of the influence of day length on flowering by Garner and Allard in 1920. They made this discovery by attempting to explain why the Maryland Mammoth variety of tobacco would not flower outdoors in the vicinity of Washington, D.C. These scientists, who were in the U.S. Department of Agriculture, were able to produce early flowering of this variety by giving short days through placing the plants at appropriate times in light-tight boxes. This illustrates how important scientific discoveries may be made with simple equipment! In retrospect, it seems strange that this important discovery was not made much earlier since a number of observers had previously pointed out facts related to this phenomenon. (For an accompanying article on the photoperiod, see page 43.)

Not only flowering, but also the phenomenon of leaf-fall may be linked to day length. Trees near a street light may retain the leaves well into the winter and thereby suffer freezing injury since proper autumn hardening-off of tissues does not take place.

One might perhaps expect that tropical plants, where the day lengths during the year do not vary greatly, would not be particularly responsive to photoperiod. This is not the case; many plants from

The fluorescent light fixture at right is typical of the simple light units available commercially for indoor gardeners. A timer for turning the light on and off automatically has been installed. African-violet plants are placed on pebbles in the tray which is filled with about an inch or so of water to increase humidity in the atmosphere around the plants.



Photographs by George Taloumis

the tropics are quite sensitive to day length. In fact, cases are known where the response will take place with as little as a 15-minute change in the length of day. A plant can time this accurately because of a built-in 24-hour endogenous rhythm (circadian rhythm) not fully explainable at present.

The formation of tubers or storage roots as in the dahlia is often related to the photoperiod.

Phytochrome

A second major advance in control of flowering was made by a group of scientists in the U.S. Department of Agriculture. This group, under the leadership of Hendricks, isolated and identified, chemically, an unstable pigment, phytochrome, which is involved in the photoperiodic response. It is a protein, a blue pigment found in such minute quantities in plants that it is not ordinarily visible. It is also common in seeds where it is associated with light sensitivity and dormancy responses. From a plant standpoint, red light is defined as that part of the spectrum with wavelengths ranging from about 580 to 720 millimicrons and the far red light from 720 to 800 millimicrons. Part of the latter range is invisible to the human eye. Lettuce seed is encouraged to germinate by brief exposure to red light (sunlight) and is inhibited by exposure to far red. Many weed seeds require light to germinate and this explains why culti-

vation is often withheld following chemical weed control to avoid bringing a new set of weed seeds to the surface where they will germinate.

The activity of the two types of phytochrome depends on a change of form according to the type of light. Exposure to sunlight or red light for a sufficient length of time will produce the active form of phytochrome. Exposure to darkness or to the far red band of the spectrum will produce the inactive or inhibiting form.

Phytochrome possibly acts in connection with the biological clock of plants as a trigger mechanism in some way not fully understood at present. There is also some evidence that another flowering hormone is involved. (See also page 54.)

Practical Control of Flowering

The florist industry provides the most striking illustration of the practical commercial application of artificial control of flowering. For many years, chrysanthemums have been available at all seasons through producing the desired effective day length by shading with black cloth or by giving supplemental light. Economy in lighting can often be obtained by flashing lights intermittently or by applying the supplementary light in a specific time during the dark period.

These treatments have by no means been confined to glass house or plastic green house growing. Substantial acre-

ages of such field-grown crops as Shasta daisies have been produced commercially out of season by batteries of lights in the fields.

Plant breeders produce some agronomic farm crops for a specific latitude. Thus, a variety which would be very good at one location might be a failure at a point two hundred miles south or north.

Controlled Environment Research

The development of environmental controls for plant experimentation was pioneered by F. W. Went, who planned and built the "phytotron" at the California Institute of Technology at Pasadena. Some important research, especially on the relationship of day and night temperatures came from this institution. The

most important result was stimulation of interest in this type of experimentation in various parts of the world, and focusing of advanced engineering capabilities on this problem. The installations made use both of natural sunlight and artificial illumination. Steady advances in technology have improved the quality of experimentation. Outside of the United States, important centers of research are at Canberra, Australia, near Paris, France and elsewhere. Numerous well engineered portable units are available commercially and are now widely used by plant scientists in many fields. There is now a strong emphasis on ecological and environmental studies and unquestionably this emphasis in plant experimentation will be important in the next decade. ♦



Melon Plants Under Lights

A MATEUR vegetable gardeners may easily follow Robert Dauch's 12-step method for raising earlier melons by starting the plants under Gro-Lux fluorescent tubes. Mr. Dauch of Clyde, Ohio, is a commercial grower who starts thousands of plants in the manner described below. The use of lights has increased production by giving a week to ten-day longer growing season, which means an earlier market and \$2 to \$3 more profit per bushel of melons. Mr. Dauch also states that he obtains larger and better quality fruits. This method is especially recommended for gardeners in the more northern climates where the growing season is too short for most long-season crops, but the fact that Mr. Dauch's melons are of such high quality might induce gardeners in more southern areas to experiment with light.—*Indoor Light Gardening News*, Nov.-Dec. 1968

1. Seeds planted between April 10 and 15.
2. Use sterilized soil in 2 1/4-inch or 3-inch peat pots.
3. Fill pot with medium to 1/4 inch of the top and wet thoroughly.
4. Plant 2 seeds (good hybrid seed) in each pot.
5. Fill top 1/4 inch of pot with dry soil.
6. Pots are placed in flats (18" by 12 1/2") filled with agricultural vermiculite.
7. Cover flats with very thin clear plastic until the seed germinates. Temperature 70 to 80 degrees F.
8. Place flats as close to Gro-Lux tubes as possible.
9. Maintain a temperature of 62 to 69 degrees F. after the plants are up and growing.
10. Raise the lights as the plants grow. You may let the plants grow and touch the tubes.
11. Plant the potted plants after the frost free date in plastic mulched field.
12. Plant the pot to a depth so that the pot is completely covered and pack the soil firmly around the plants.

One of the most vital activities on earth—

THE PROCESS OF PHOTOSYNTHESIS

Peter K. Nelson

ONE of the more obvious of the many characteristics that distinguish living organisms from non-living is that living things do things—they carry on many functions and activities and these require that energy be expended. Energy cannot be created—it can only be transformed from one form into another. Even in the atomic bomb or in atomic power plants energy is produced only by the transformation of matter into energy. Unfortunately, the conditions for thus transforming matter are very special, and for the most part highly inimical to life, so we cannot obtain the energy we need for our bodily functions and activities in this way.

There is, however, a source conveniently far enough away that we do not risk danger from its harmful aspects, yet near enough that the energy released from it can reach us in sufficient amounts; in this source, the sun, matter is being transformed into energy in tremendous amounts and at a remarkably uniform rate. The energy released by the sun pours out into space and bathes the earth and the other planets. This flood of energy reaches us as radiant energy, mostly light, and it is there for the taking. But, there is a catch—it is no simple matter to capture energy in the form of light, and transform it into the chemical energy needed by living cells. Not only must it be caught and transformed, the energy also must be put into a form in which it can be stored. Animals and fungi lack the ability to do this; only green plants and a few comparatively rare colored bacteria are able to carry out the process. As a result, animals, including man, are wholly dependent upon the green plants for the entire supply of energy they need to function—to move about, to grow, and to reproduce.

The "trap" that plants use to catch and

transform light energy coming to earth from the sun is a remarkable chemical compound, chlorophyll. This is the pigment which gives green color to leaves (the word *chlorophyll* literally means green leaf). Molecules of chlorophyll absorb light, especially blue and red wave lengths and transform it into chemical energy which is stored in the form of carbohydrates. Remarkable and unique though it is, chlorophyll is not able to accomplish the whole process by itself. The job must be done in an intricate series of physical and chemical steps involving various complex chemical substances such as enzymes and pigments called cytochromes. Moreover, these cannot simply be mixed together, but must be arranged in an orderly way so each step in the process will occur in its place.

In most plants the organs in which photosynthesis takes place are the leaves, though it can occur to a greater or less degree in any green part. A cross-section of a typical green leaf shows it to be a sort of sandwich. On the top and bottom are thin membranes: the upper epidermis and the lower epidermis, usually but one layer of cells thick. The "filling" of the sandwich is tissue called *mesophyll*. This is usually differentiated into two parts: an upper layer called the palisade layer because its cells are packed more or less closely together with their longest dimension vertical, much like bricks placed on end; and a lower layer of irregularly shaped, loosely packed cells called, logically enough, the spongy layer. Running through the mesophyll and acting both as a supporting framework and as a conducting system by which fluids enter and leave the leaf is an extensive network of veins. While there are, to be sure, many variations of this basic plan, it is quite astonishing how closely it is adhered to throughout the tremendous variety of

flowering plants.

Any object as thin and spread out as a typical leaf is obviously very subject to drying out. This is to a large extent mitigated by thin layers of waxy material called cutin which are produced by and which cover the outer surfaces of the epidermal layers. This cuticle varies in thickness from species to species. It may be missing entirely in submerged aquatics, and is heavy on leaves of plants growing in hot, dry areas. In one kind of palm it is so heavy that it can be scraped from the leaves and constitutes the valuable carnauba wax of commerce.

Covering the leaves with waxy material conserves water, but poses in its turn another problem—that of exchanging gases between the cells of the leaf and the air. Like all other living cells, with the exception again of certain bacteria, leaf cells require oxygen in order to function, using it to release the energy stored during photosynthesis. Furthermore, carbon dioxide from the air is one of the two raw materials used in photosynthesis, the other being water. So some means for permitting these gases to pass in and out of the leaf is necessary; this is provided by small pores called *stomata* which are found in the epidermal layers. The pores are formed by pairs of sausage-shaped cells, facing one another like parentheses, thus: (). When these cells are filled with water, technically in a state of turgor, they are taut and curved, and the pore between them is open. Gases can then pass freely in and out of the leaf. However, if they lose water, as will happen when the leaf wilts, their stiff facing walls tend to straighten out, narrowing or even closing the pore. Thus the stomata allow for the movement of gases, but at the same time check the loss of water by automatically closing when this is in short supply.*

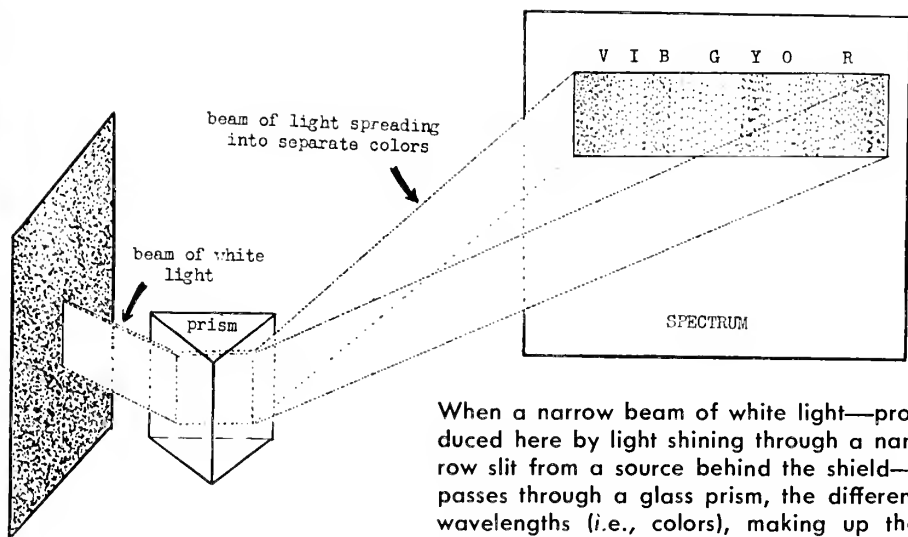
Photosynthesis goes on only in green cells, principally those of the palisade and spongy layers of the leaf. Looking at one

of these cells under the microscope we see at once that the chlorophyll is not evenly spread throughout the cell, but is localized in small green bodies embedded in the living substance (cytoplasm) of the cell. In by far the majority of plants these bodies, called chloroplasts, are lozenge-shaped, but in some algae they appear as spiral ribbons, stars, and other forms. Under the microscope they are extraordinarily beautiful. Usually the chloroplasts appear to be a uniform, translucent green when viewed under the microscope, but under certain conditions there is a suggestion that within these bodies themselves the chlorophyll is not uniformly distributed. For years this point was debated until the advent of the electron microscope with its tremendous magnification, which settled the matter without question: within each chloroplast the pigment is arranged in smaller structures called *grana*. In general these grana resemble stacks of coins, or better, stacks of very thin, flat pillboxes. The chlorophyll and other molecules necessary for photosynthesis are located on or in the

ABSORPTION OF LIGHT BY LEAF

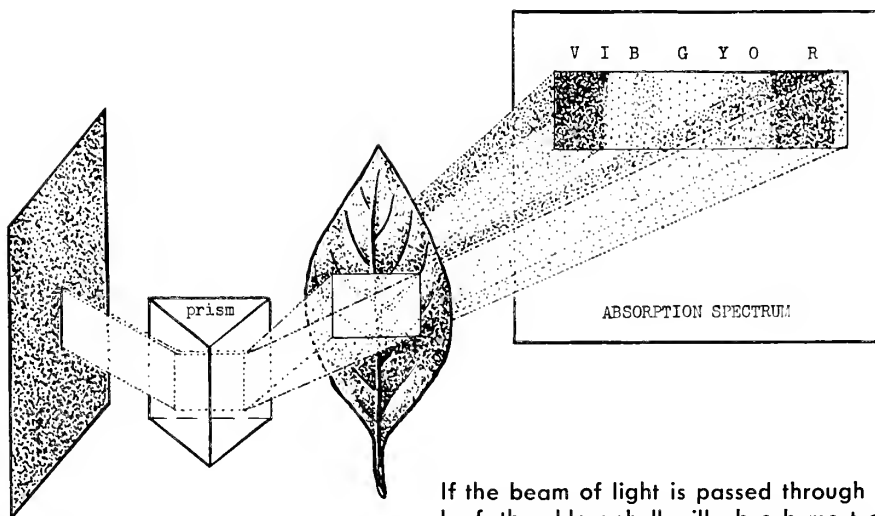
The pigments in leaves and other plant parts absorb light differently; some wavelengths are absorbed while others are reflected and/or transmitted. Only the absorbed light is of any use in various processes in the leaf. The diagram on the facing page shows how it is possible to find out which wavelengths are absorbed and which are not. Actually, the diagram is oversimplified for clarity: only the absorption due to chlorophyll is shown. Other pigments in the leaf would absorb other colors. So far as a plant is concerned, the source of light is immaterial—it is only necessary that the wavelengths of light absorbed to carry out a certain process be present.

*Recent unpublished scientific work indicates that light is instrumental in controlling the amount of water in the stomatal cells.



When a narrow beam of white light—produced here by light shining through a narrow slit from a source behind the shield—passes through a glass prism, the different wavelengths (i.e., colors), making up the white light, are bent by differing amounts, thus separating them from one another. If the light is then allowed to fall on a screen, a band of colors called a *spectrum* is seen.

Drawings by Peter K. Nelson



If the beam of light is passed through a leaf, the chlorophyll will absorb most of the red and violet light. This will result in dark bands in the red and violet parts of the spectrum, which is now called an *absorption spectrum*.

walls of the "pillboxes" (technically called *thylakoids*) that make up the grana. Experiment has shown that the complete job of photosynthesis can be performed by the grana. Even if they are broken, the pieces can carry out the work—within certain limits. If the membranous walls of the grana are broken into pieces that are too small, that is, less than could contain about 300 chlorophyll molecules, they can no longer completely perform photosynthesis. This fact, with much other experimental evidence, has led to the idea of the photosynthetic unit, in other words, the chlorophyll and other necessary molecules are arranged in clusters or groups, each of which constitutes a complete machine for performing photosynthesis. At the present, work is being carried on to determine more precisely the size and composition of these units, as well as their relation to the membranes of the grana. It is not certain as yet whether they are lined up on the surfaces of the membranes, or whether they are packed together somewhat like tiles or pieces of a mosaic to actually form the membranes.

Having examined at some length the physical plant in which photosynthesis goes on, let us look a little further at the process itself. Of necessity we can take only a broad, and to some extent superficial view, since to examine photosynthesis in all its details, even incompletely known as they are at present, would involve us in physical and chemical discussions far too lengthy and complex to go into here. For those who wish to pursue the matter, several excellent and reasonably up-to-date references are given at the end of this article. I say reasonably up-to-date because, after several hundred years during which almost no progress was made in our understanding of photosynthesis, at the present time knowledge is advancing at such a rate it is difficult to keep pace with it.

The over-all process of photosynthesis seems deceptively simple: green plants combine carbon dioxide from the air and water in the presence of light to produce carbohydrates and oxygen. During the process the energy of the light is stored in

the carbohydrates. Our understanding of the process is this: when the chlorophyll absorbs light it is able to then split water into hydrogen and oxygen. The oxygen is released, literally as a waste product, and the hydrogen is combined, not directly with the carbon dioxide, but with an intermediate substance. A certain amount of an energy-storing compound called ATP is also formed. This is the only part of the process that needs light; once it has been done, the rest can proceed in darkness.

The intermediate compound, with the help of energy stored in the ATP, transfers the hydrogen it received during the light reaction to carbon dioxide. This is accomplished in a series of very involved chemical steps, but we need only be concerned with the end result—production of carbohydrates (sugars). The simple carbohydrates first produced can then be manipulated chemically to give a number of other more complex carbohydrates, such as cane sugar and starch, and, with further chemical processing into more complex materials, such as cellulose, fats and proteins. By recombining the carbohydrates with oxygen, living cells get back the carbon dioxide and water which were the starting materials, and the energy stored is released to be used. In addition, the carbohydrates and their derivative materials are the building blocks from which the living cells themselves are built up.

For Further Reading

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- In *Scientific American* magazine:
- E. I. Rabinowitch and Govindjee: *The Role of Chlorophyll in Photosynthesis*, Sci. Am. 213 (1965), pp. 74-83.
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LIGHT AND DORMANCY

Why do woody plants go dormant in the fall?

R. Milton Carleton

THAT QUESTION has puzzled plantsmen and scientists for generations. Along with it has been the still-larger mystery—that of hardiness and plant survival.

An internal mechanism has been discovered which is responsible for inducing dormancy—a chemical called Dormin* or abscisic acid. As fall approaches, this chemical is accumulated in woody plants and reduces physiological activity to a bare flicker of life within a tree or shrub.

As plants are exposed to cold—for longer periods in the North, shorter in the South—the dormancy chemical is gradually destroyed. By spring this “counter hormone,” as it is sometimes called, has disappeared completely, and

plants begin to grow again.

But what is the mechanism which initiates the accumulation of this vital chemical? Although cold is commonly assumed to be the basic cause of dormancy, this is not the case. Woody plants begin to get ready for winter long before low temperatures are experienced. Actually, the onset of winter rest takes place even before temperatures of 40° F (the point at which physiological activity in many plants comes to a halt) have occurred.

About mid-August in the North, terminal growth comes to a halt on twigs of shrubs and trees. This takes place even during late summer heat waves. If food and water are available in reasonable quantities, a slight swelling in twig diam-

*This plant hormone, which triggers the onset of dormancy, has been chemically identified as abscisic acid. The pigment phytochrome (not a hormone) is also causally associated with dormancy, but just how it works is still a puzzle.



Trees and other woody plants prepare for dormancy long before temperatures drop.

eter occurs. What is happening is that the plant is storing starches in its tissues. The storage of this food energy is essential for the production of new foliage in early spring.

Onset of Dormancy

There is good reason to believe that the onset of dormancy and synthesis of Dormin within the plant are due to either a change in day length or to a shift in light color quality. The latter, at least as far as I have been able to check, is probably the more plausible theory. Woody plants, exposed to light rich in red and low in blue, went through typical changes associated with dormancy. Although the change from the growth phase to dormancy was slower when plants were under 15 hours of light (as compared with 11 hours), it did take place.

The change from light which is rich in

blue to one stronger in red and far red takes place naturally in the open. As the sun sinks lower and lower in the southern sky with the approach of winter, its rays must penetrate an ever-increasing thickness of air. This filters out the shorter violet and blue rays but allows red and far red to go through.

Artificial Light and Dormancy

Subjecting plants to artificial light which favors dormancy could have practical applications to horticulture. For example, it could be used to condition hydrangea, azalea and other plants for forcing. By making possible the year-round forcing of seasonal plants, it could give florist subjects as important as the chrysanthemum has become following the discovery of day-length control in that species, once only available during the fall and early winter months. ♦



The Plastic Shoe Box as a Propagating Aid

THE PLASTIC SHOE BOX remains in my experience the most successful means for rooting leaves and stem cuttings. The boxes, which must be of a clear plastic, including the covers, are available in variety and houseware outlets. Do not drill any holes in the bottom, sides or top of the box. Cover the bottom with about an inch or more of vermiculite, add water to wet the particles but sparingly to avoid leaving a pool of water. (Tip the box to drain away excessive water.) The cover can be left partially open for a few days if you fear the vermiculite is too moist. Actually, it is amazing how little water is required to supply the necessary humidity for these enclosed boxes. The initial moistening of the vermiculite is sufficient for a long period—up to six months or so. As long as the vermiculite is moist to the touch, there is quite enough moisture in the box. Use a pencil to make a depression for the stem or leaf cutting and then pack the vermiculite around it. Fleshy or soft cuttings sometimes have a tendency to rot. Remove them as soon as noticed to avoid fungus troubles, which could prove harmful to other cuttings in the box. The box should be kept about 3 inches from the fluorescent tubes. The cuttings can be transplanted as soon as a root system has formed. Remember that they have rooted in very high humidity and should be hardened off when transplanted. Placing them in a closed plastic bag for a week or so and then gradually opening the bag permits the plants to adapt to their new, less humid environment.—Murray D. Morrison from *Indoor Light Gardening News*, Nov.-Dec. 1968

The human eye sees color in a different way than does a plant . . .

HOW PLANTS "SEE" COLOR

R. Milton Carleton

ALTHOUGH the human eye is a highly sensitive "instrument" in measuring relative light *intensity*, it is much less sensitive in detecting variations in color quality.

For example, the eye has difficulty in telling whether a light source is rich in blue unless it is seen close to one rich in yellow or red. Since the one low-cost device for measuring light—the photographic light meter—is adjusted to the human eye, it is not a good device for use with plants. We must still rely on it for intensity, but where no other information is available, measurements in foot-candles must be used.

Man sees blue fairly well in a narrow band of the spectrum—the same band which stimulates the production of chlorophyll that makes leaves green. Oddly enough, while the band of light is narrow, the field of vision for blue is wider than for any other color. A practical application of this peculiarity is in landscaping. In planting a border in front of a picture window, blues can be placed at the edges of the view, with reds, yellows and purples in the center. The human eye can encompass the entire scene more readily in such an arrangement.

Visually, the eye is most sensitive to a wide band of green in the spectrum, to a similar band in the yellow section, and somewhat less sensitive to orange. In contrast, while plants respond to blue light, they are almost completely insensitive to yellow, green and orange, but are profoundly affected by red light, particularly that adjacent to the orange band in the spectrum. Beyond this red band lies far red, a color barely seen by the eye, but which has profound effects on plants.

Plants are insensitive to green because they do not absorb it, but reflect it back to the human eye.

Nearly everyone is familiar with the wave theory of light emission, but less so with its identification and measurement. Light is emitted in waves of various lengths which are measured in millimicrons. The non-scientist is often confused because three different terms are used to describe various colors in the spectrum. The first, the Ångström unit, is a number 1,000 times the millimicron measurement between crests of light waves. The second is the actual measurement in millimicrons, expressed as a whole number rather than a fraction. The third is identical to the second, but called nanometers instead of millimicrons. Older references are in Ångström, newer data in millimicrons, while in the future, probably nanometers will be the term used.

The term "foot-candle" is a measure of light intensity without any reference whatever to color quality, and since plants do not "see" all of the colors in white light, this term is only a rough guide to the amount of radiant energy a particular light source provides.

In the light spectrum of a tube or bulb, the shortest rays emitted are in the ultraviolet range. They are invisible to the human eye, although certain individuals are able to detect some of the longer ultraviolet rays. In general, ultraviolet radiation is harmful to plants, although plants of the high mountains tolerate two to three times the dosage lethal to those from lower altitudes. Radiation above 2,537 Ångströms is usually fatal to all plant life, including bacteria and fungi.

Longer rays of ultraviolet, 3,000 to 3,900 Ångströms, can be fairly well tolerated by most plants in small doses—almost all plant-growing tubes emit some ultraviolet in this range. Actually, if temperatures can be kept low, they can even be beneficial.

(Continued)

In the visible violet range, between 3,900 Ångstroms to 4,220, practically no effect is visible in plants. Between 4,220 and 4,920 is the blue range. At approximately 4,400 Ångstroms, chlorophyll synthesis takes place—one of the most vital processes in the world. As already mentioned, through the yellow, green and orange sections of the spectrum, plants simply do not “see” light. At about 6,600

Ångstroms, however, another vital physical process is stimulated—the growth, development, flowering and fruiting of plants.

At around 7,500 Ångstroms, the favorable effects of light cease: exposure to this far red light—barely visible to the human eye—results in a slowing of growth, failure of seeds to germinate and other effects generally unfavorable. ♦



Photographs by George Taloumis

Light requirements of African-violets vary. Place varieties which need the most light directly under the tubes and in their center.



Frequent temperature check-ups may be required when tubes are close together as too much heat results for the plants' welfare.

Spacing of Fluorescent Tubes

IN AN EFFORT to obtain all the light possible over a given area, many amateurs build fluorescent lighting units with tubes spaced so closely together that they practically touch.

Crowding tubes together is self-defeating for a very simple reason: light impinging on one tube from another is reflected or radiated as heat rather than light. This additional heat is an unfavorable condition in plant growth under fluorescent tubes, and must somehow be dissipated.

Tubes, with one half the glass metallized to form a reflector, are available, but unfortunately are not stocked by most lamp dealers. If they are mounted to reflect the light downward, an increase of light energy of as much as 50 per cent over unreflectorized tubes is possible.

Where standard tubes must be used, a spacing of 6 to 8 inches apart should be maintained, which will result in less light-to-heat conversion than if they are placed closer together.—R.M.C.

Artificial light can hasten the ripening and improve the quality of tomatoes

BETTER TOMATOES WITH ARTIFICIAL LIGHT

A. L. Shewfelt

IN RECENT YEARS there has been renewed interest in the use of light for the ripening of certain fruits, including tomatoes. Home gardeners, and those whose hobby includes the use of artificial light for growing plants indoors, may find they can improve the quality of their tomatoes by subjecting them to artificial light treatment. And since the quality of most tomato products depends heavily upon a rich red fruit color, any means to improve color is of wide interest.

It is possible that the light treatment can also be applied successfully to apples, peaches, and pears. Only a limited amount of equipment is necessary for home use. In order to obtain satisfactory results with artificial light on tomatoes, consideration should be given to a number of factors that affect their ripening. Most of the recommended varieties are capable of developing suitable color under the right conditions.

The Right Conditions

First of all, the tomato plant that provides the fruit should be grown in an environment that is normal and characteristic for the species. Fruits should remain on the plant at least until they have reached maximum size and their deep green color begins to fade. This is normally referred to as the mature green stage and immediately precedes the "breaker" stage, at which time a tinge of pink color shows up at the blossom end of the fruit.

Mature green fruits will develop maximum red color either on or off the vine if they are maintained at a temperature of 70 to 75° F. The exceptions are those that have been subjected to a temperature

below 50°F for a day or more, or those that may be infected with rot. If the ripening temperatures are too high, the red pigment (*lycopene*) will break down and the result will be light orange-colored fruits. Temperatures below 70°F will not allow the development of full red color, and, as indicated above, temperatures below 50°F may result in low-temperature injury and preclude further ripening.

Light Not Vital for Color

Light is not essential for the development of red color because mature green fruits may be stored in total darkness and yet ripen satisfactorily. The purpose of introducing artificial light into the ripening process is mainly one of increasing the rate of ripening, thus reducing the holding time of the fruits and also reducing the time that the fruits are exposed to spoilage conditions while ripening.

I have found that certain types of fluorescent light have a marked effect on increasing the rate of red color development and that exceptionally high quality fruits may be obtained from mature green tomatoes exposed to light. Fruits that required seven days in darkness at 72°F to attain maximum redness developed the same degree of color under light in about half the time. Furthermore, the texture, odor, and flavor of the fruits exposed to light were generally preferred to those ripened in the conventional manner.

The type of light was found to have an effect on the ripening process. Incandescent light, while included in plant growth chambers, is not particularly suitable for tomato ripening because of its high heat generation. Gro-Lux fluorescent

sources had considerably more effect than the standard Cool White type. The standard Gro-Lux was compared with the Wide Spectrum Gro-Lux source, the former being generally preferred for tomato ripening—since it provided a slightly faster rate of ripening and at the same time excellent flavor and texture. This source has a dominant wavelength emission peak near 650 millimicrons. Partially ripened fruits, during exposure to this source, reflect an abnormally high amount of redness. This appearance should not be confused with the natural redness reflected from full-spectrum light such as sunlight.

I have obtained satisfactory results with light fixtures equipped with 3- or 4-foot fluorescent lamps (40-watt size), positioned 18 inches above the surface of the fruits and connected to a clock timer similar to that used in the home for lamps and electrical appliances. The timer automatically allowed 16 hours of light exposure during each 24-hour period. Under these conditions, the temperature of the fruit surface was 2 or 3 degrees above that of the surrounding air, a factor that may need to be considered if the fruits are to be maintained within the optimum temperature range for ripening. The light treatment had no major effect on the levels of acidity or ascorbic acid (Vitamin C) in the tomatoes. There has been some indication that the effect of light

treatment is a bit greater for mature greenhouse-grown green tomatoes than for those grown outdoors. Also, the degree of general quality improvement with light treatment has been greater for greenhouse-grown tomatoes which are characteristically lacking in attractive flavor and color.

Treatment for Store and Home-grown Fruit

At present, the application of light treatment to the commercial fresh and processed tomato industry still lacks the advanced technology required to make it a feasible process. On the other hand, the relatively high retail price of fresh tomatoes in relation to the low prevailing quality suggests that marked changes are needed in the marketing practices of this commodity and that light treatment may indeed be part of the answer.

For those who grow their own tomatoes and wish to apply light, it is a simple matter to expose mature green or partially-ripe fruits to the recommended light sources at room temperature and observe the results in 3 or 4 days. Similar treatment may be applied to tomatoes from the local market. Unless the fruits have been subjected to rot infection or cold temperatures, they will be a luscious red-ripe color and superior in quality to the tomatoes that are now generally available to the consuming public. ♦

George W. Park Seed Co.



The Sylvania sun lamp is one of the smallest indoor light units. It can be used to color green tomatoes and other fruits and is large enough to hold a plant or two.

Primroses are among the perennials whose seeds benefit from an indoor sowing . . .

LIGHTING THE WAY TO HEALTHY SEEDLINGS

Alice Hills Baylor

THE EASE with which sturdy perennial garden plants and vegetables can be raised from seed by the use of fluorescent lights would surprise those who still cling to the window-sill method. Under lights the seedlings are not "leggy" nor do they fall over and die. They are all deep green in color and possess strong stems. The uniform amount of light is the reason.

Here at Sky Hook Farm in northern Vermont, we raise hundreds of garden primroses from seed without the aid of a greenhouse. The heavy snow and the extremes in temperature in February and March (from 20-30 above to 20-30 below zero within a twenty-four hour period) would make greenhouse management difficult. Then, too, a greenhouse would be useless during other periods of the year as all our primroses are hardy.

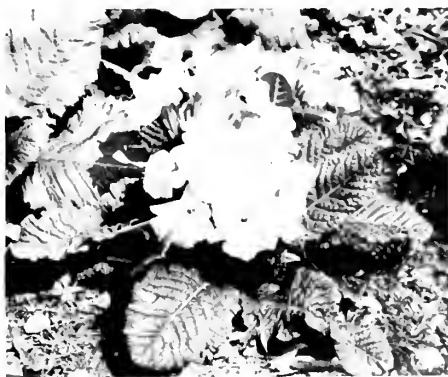
There are ready-made frames containing fluorescent lights on each shelf for those who desire to raise only a few plants (see page 9). If one wishes to have a good supply or a complete garden of plants or vegetables, the use of 4-foot tubes is practical. Our equipment is built to accommodate a large number of flats. We use the double 4-foot tubes under which we can place six of our flats.

Benches were built to a convenient working height in our 60° F basement and covered with heavy plastic. Strips of wood, one inch wide, are laid on the plastic between the heating cables. The flats are placed on top of the stripping. Thus air and heat can circulate under the flats.

Above the benches are the free-

swinging frames on which are mounted the 4-foot double fluorescent lights. These frames have pulleys so that the space above the flats can be adjusted. Two to 3 inches is the proper height of lights above seeds that have just germinated. As the seedlings grow the lights are raised. Annuals develop quickly and the lights must be raised accordingly. Perennials are slower and can take lights at a lower level. If the plants look "leggy," put the lights closer as they will be reaching for more light. Most annuals and perennials need from 16 to 18 hours of light a day for good development and growth. Aluminum foil is tacked to a frame at the back and on the sides of the bench so that more light will be reflected onto the flats.

The time to plant perennial seeds in the north is in February and March for they take longer to germinate and develop slowly. Annuals should not be planted as early unless one has ample space to take care of the plants when it is time to transplant the seedlings into a growing flat or into separate pots. ♦



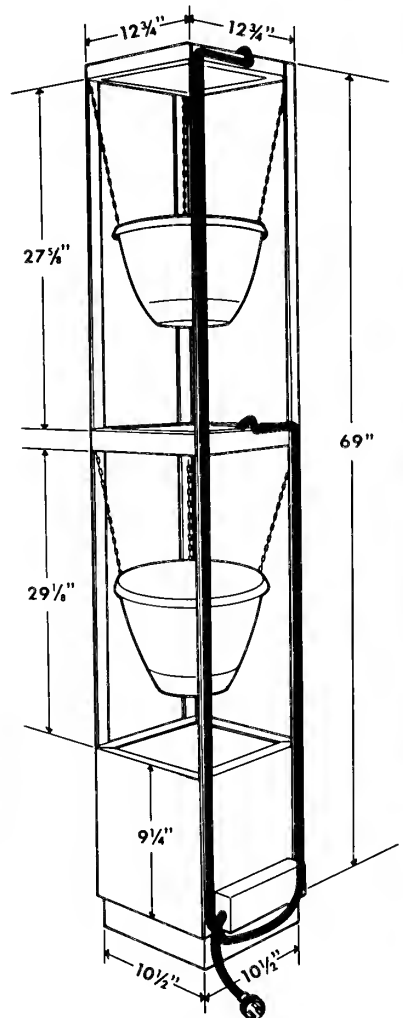
Most kinds of the hardy primrose may be grown from seed sown under lights.

Adapted with permission from the *Indoor Light Gardening NEWS*, May-June 1969.



This vertical indoor garden is designed for hanging plants in waterproof baskets. It can be easily moved to clean surrounding floor and carpets. Plants are conveniently located for care and replacement. The fluorescent light source is located just above each plant.

USDA Photo



Ideas for

INDOOR GARDENS UNDER LIGHTS

Right: This indoor light unit is available commercially and is especially suited to the needs of African-violet hobbyists. The unit belongs to Mrs. R. Klastorin of Brooklyn who grows over 400 plants in it. *Below:* The incandescent lamp's primary purpose is to show a collection of African-violets previously grown to flowering stage elsewhere under fluorescent tubes.



Roche

Arthur Norman Orans



Ideas for Indoor Gardens Under Lights

Indoor light garden in a dining room—

The plants run along two sides of the room; a floor-to-ceiling aviary covers the third side. This indoor garden, which is in the home of Mrs. Diana Miller, overlooks the outer garden; the result is a blend of indoor and outdoor greenery.

The lights, two cool General Electric white tubes (the only types available from the local dealer), are in a standard 96-inch industrial fixture. They are operated with a timer set for 16 hours of light a day. When the house is heated, a cool-mist vaporizer is connected to the timer.

The combination of fluorescent light and the eastern exposure of the windows gives a wide range of lighting conditions. Mrs. Miller is able to grow all kinds of begonias. She uses coleus plants as fillers and as a colorful background. 'Vesuvius,' one of the sensitive, dark-leaved rex begonias, performs best between the windows where it is not reached by daylight, but the pendulous angel wings begonias are in a raised planter exposed to full daylight with the top leaves 2 inches from the light. The plants bloom profusely under these conditions. A few dwarf geraniums flower in the brightest areas at the back of the raised planter.

All pots are sunk in 3 inches of peat moss, kept moist. Miniature ivy plants and various cuttings grow directly in the peat moss. The table itself consists of two 12-inch pine boards covered with green plastic. The boards are edged with 2x4's to contain the peat moss.

Arthur Norman Orans







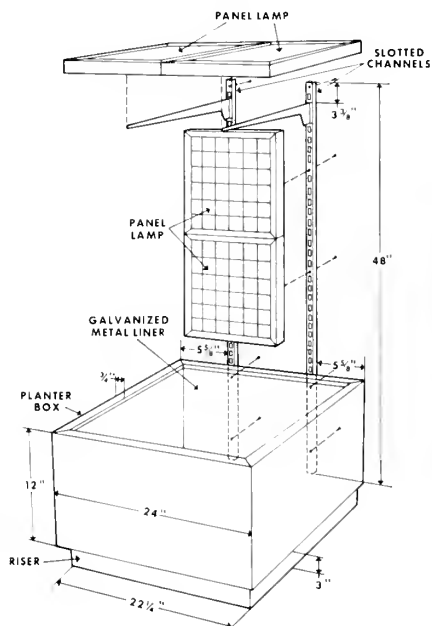
Duro-test Light Bulb Center

Interior garden under the stairs—This 10- by 12-foot garden is illuminated to 400 to 600 foot-candles with full-spectrum Vita-lite fluorescent tubes. A wide variety of plants—bromeliads, various kinds of ivy, cacti and succulents—are grown. The foliage plants in the back area beyond the stairs are illuminated by 250-watt R40 Fluomeric (self-ballasted mercury vapor) lamps and have responded remarkably to these lighting conditions.

Ideas for Indoor Gardens Under Lights

Indoor garden as a focal point—

Here is a lighted planter which can serve as the major decorative accessory in a room. The planter, which is 2 feet square, can be made of fir or veneer plywood. It should have a water-tight liner which is best made of sheet tin and painted with asphalt to retard rusting. With fluorescent lamps attached to the rear standards, as shown here, the lighting intensity is high enough to permit good growth of flowering plants.



USDA Photo



Arthur Norman Orans

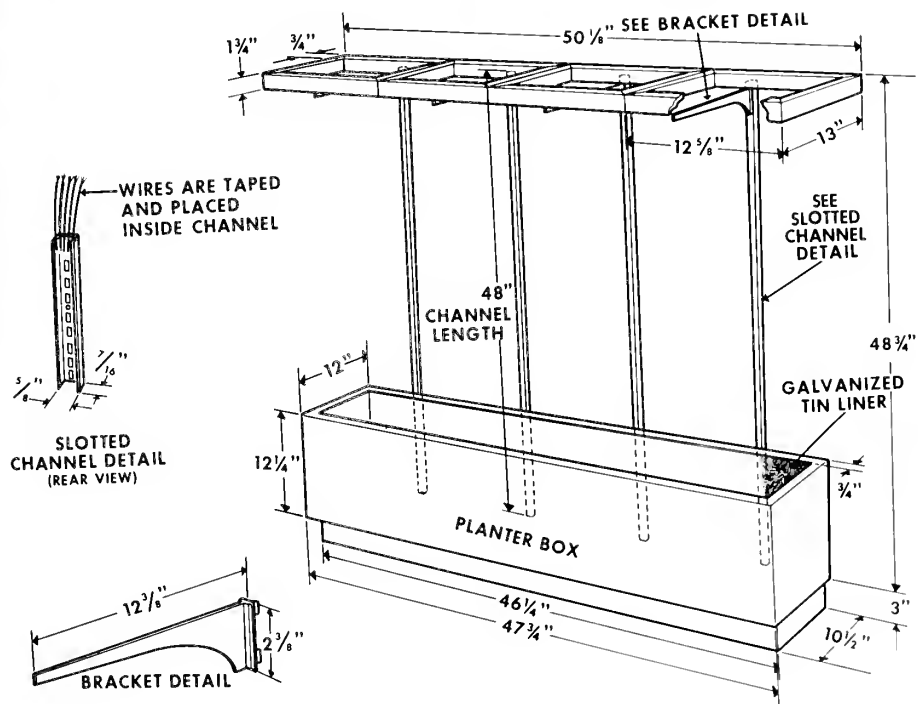
This indoor light unit, maintained by Mrs. R. Klastorin, has adjustable shelves and light fixtures. Similar models are available from indoor garden specialists.

Ideas for Indoor Gardens Under Lights

This horizontal indoor garden is most useful as a room divider or in a narrow corridor or hallway. The box should have a watertight liner which can be made of sheet tin painted with asphalt to retard rusting. For a temporary liner, heavy polyethylene sheeting may be stapled inside the planter.



USDA Photo



ARTIFICIAL LIGHT SOURCES FOR GLOXINIA, AFRICAN-VIOLET AND TUBEROUS BEGONIA

James W. Boodley

THE CONTROL of plant environment has been the ambition of every plantsman since the days Edison first invented the incandescent lamp. The various phases of environmental control and their effects on plant growth are dealt with in several other articles in this handbook, and my object is only to show how the quality of light from different fluorescent sources affects the growth and flowering of certain popular and rather easily grown plants.

Fluorescent sources of light have radiation that is dependent primarily on the phosphors that are used within the bulb and the mercury that is used as the source of excitation of the phosphors. Mercury produces light in the ultra-violet range that, if not converted to the longer wavelengths by the phosphors and also screened by the tube, could cause severe damage to the plants. Energy sources high in the blue end of the spectrum do cause plants to develop a squat, stocky-type growth if these sources are not balanced with red energy.

Within the past decade there have appeared on the market light sources that have been developed specifically for growing plants. Generally they have provided energy that is supposed to be a blend of red and blue which is said to be what plants need for optimum growth.

It is quite true that plants held under some of these light sources look extremely healthy. What you are seeing is an enhancement of color due to the reflectance of the red energy source. When the plants are removed from the light source they show a loss in their healthy looks.

Plants that do well under home lighting conditions are those that have a low-to-medium-light requirement; intensities, if measured by a foot-candle light meter, would be in the 800 to 2000 foot-candle range. Among such plants are the African-violet, gloxinia and tuberous begonia.

Gloxinias

In an earlier investigation, we compared seven different artificial light sources as a means of speeding up and getting on a regular schedule the production of bedding plants from seed. The results of these tests were so exciting that we thought gloxinias would make excellent test plants for further work.

Our experiments were designed to use only artificial light as the sole source of energy for the plants. Thus, the plants were grown in an otherwise dark cellar-like room where the temperature was maintained in a range of 65-70° F.

Seeds were sown August 2nd and the seed flats were placed 8 inches from a warm white fluorescent light source. The photoperiod (length of the light period, or "day-length") was regulated at 16 hours. In September the seedlings were transplanted to 2¼-inch pots and the experiment was started.

The light sources used were commercially available fluorescent 4-tube luminaires with 4-foot, 40-watt lamps. Two fixtures placed side by side lighted a 30-inch wide bench. In addition to the plants grown under artificial light, a greenhouse comparison trial was also set up to determine what results could be expected in the sunlight of the shorter



Photographs by Genereux

The gloxinia (above) and African-violet (below) are two flowering plants which grow and blossom very successfully under artificial light conditions.



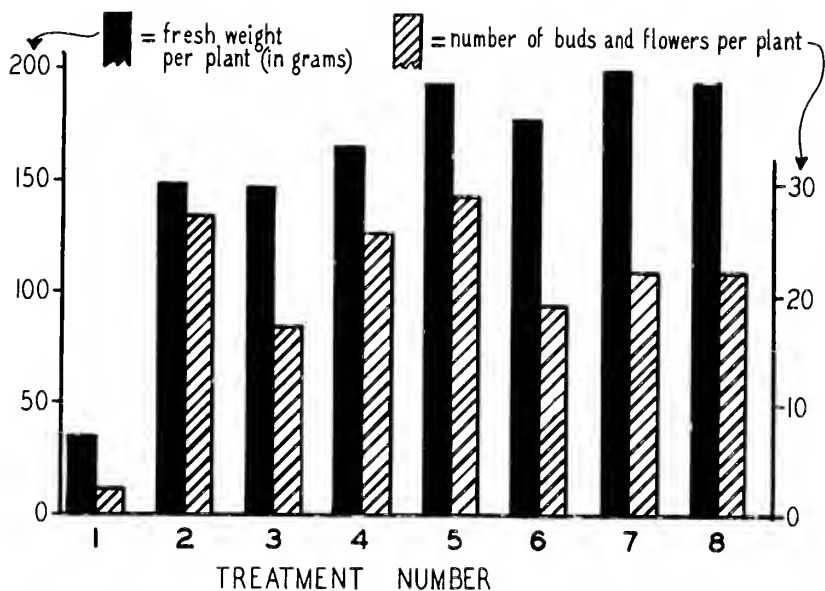


Figure 1. Growth and flowering of gloxinia 'Panzer Scarlet' as measured by fresh weight, also by number of buds and flowers per plant (average of four plants). See text below for the eight different light sources used ("treatments"). Data recorded January 6th, 154 days after seeds were planted.

days of autumn and early winter.

The accompanying illustration (Figure 1) shows the varying results obtained under the following light sources, all of which were 8 inches from light to top of plant. For convenience, the light sources are designated in the graphs by number, and are called "treatments." Numbers 2-8 designate the different fluorescent lights used.

1. Greenhouse (daylight only)
2. Warm white
3. Cool white
4. Special lamp # 1
5. Special lamp # 2
6. Special lamp #3
7. Combination natural white and day-light fluorescent
8. Combination warm white and cool white fluorescent

From this beginning we could see that on the whole the three best light sources (treatments) were numbers 5, 7 and 8. The greenhouse-grown plants were de-

cidedly inferior to any grown under artificial light sources with a 16-hour photoperiod. Bear in mind that this particular greenhouse experiment was carried on between September and January when the days were short and the light intensity relatively low.

A second study was made in the spring to compare three distances (8, 16 and 24 inches) from the light source in order to determine the most favorable light intensity for good growth and flowering. The same light sources and 16-hour photoperiod were used as in the first study. Both studies required 154 days from sowing seed to full bloom. Data for the three best light sources are shown in the accompanying illustration (Figure 2). Treatments 7 and 8 were best.

As to light intensity under the artificial light sources: Generally the growth performance of the plants was poorer at lower light intensities, *i.e.*, farther from the light source. As with the first study,

the best plants were produced at the highest light intensity tested (8-inch distance from the source). The same observations apply for the number of buds and flowers produced.

The spring season comparison trial in the greenhouse (with longer days, higher temperatures and brighter sunlight) gave spectacular results when compared to the artificial light treatments or to the autumn-and-winter greenhouse trial. Fresh weight of plants was approximately double that obtained under the best artificial light treatment, and the number of buds and flowers was five times greater than in treatment 7. However, the greenhouse plants required an additional 5 weeks to reach the flowering stage.

A subsequent study was made to find out how short the day-length period could be and still produce quality gloxinias. In this study day lengths of 8, 12 and 16 hours were used. The results showed that plants grown at 8-hour day lengths were of poor quality; they were spindly in appearance, grew poorly and failed to produce buds or flowers. Both the 12- and

16-hour day lengths were satisfactory for the production of high quality plants.

To summarize these findings we can say the following: 1) Flowering gloxinias were produced from seed 154 days after sowing, using only fluorescent light as the energy source. 2) A combination of natural white and daylight fluorescent tubes and a combination of warm white and cool white tubes were superior or equal to special commercial plant-growing lamps as energy sources. 3) A day length of not less than 12 hours gave high quality plants and abundant flowers. 4) Plants should be maintained not farther than 8 inches from the uppermost leaves to the fluorescent tubes.

African-violets

The extent of knowledge concerning the growth of African-violets under artificial light sources is probably much greater than for gloxinias. A wealth of previously published information is available.

Scientific work done several years ago established the fact that African-violets

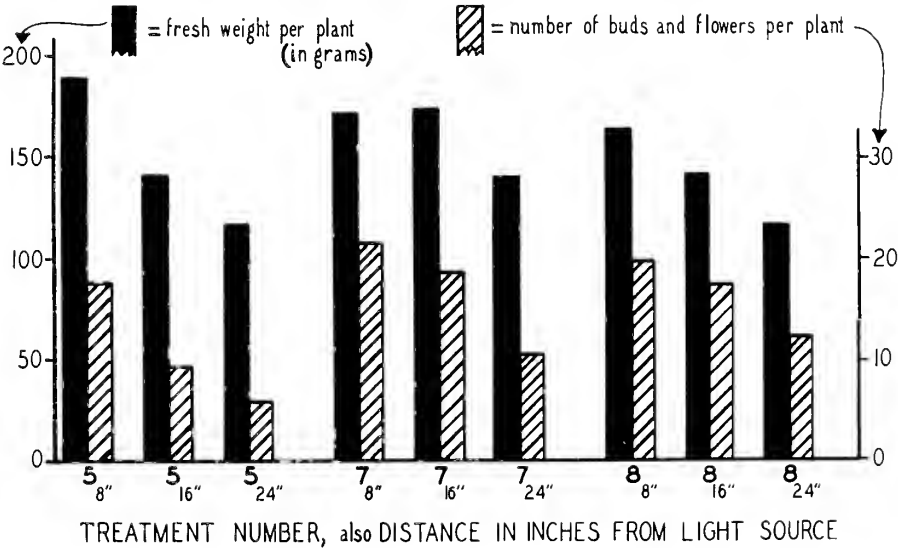


Figure 2. Influence of light intensity on growth and flowering of gloxinia 'Panzer Scarlet.' Different intensities resulted by varying distances (8, 12 and 24 inches) between fluorescent light sources and plants. Best three light sources in previous experiment were repeated and recorded here. Seeds were sown in spring and the experiment was ended in summer, 154 days later. All data average of four plants.



Genereux

Gloxinias flowered 154 days after sowing with fluorescent light as energy source.

would flower at 6-, 12- or 18-hour day lengths if the light intensity was 300 foot-candles or higher. Daylight-type fluorescent lights were used. Much better growth was obtained, however, if 600 foot-candles were applied for 18-hour photoperiods.

In more recent studies, carried out in Canada with the African-violet varieties 'Pink Lady' and 'Blue Boy,' the most abundant flowering occurred at the 300 foot-candle intensity. Cool white and incandescent lamps were combined and a 16-hour photoperiod was used.

Where Gro-Lux lamps were supplemented with incandescent bulbs to provide 15 watts per square foot, the plants produced significantly more flowers after the 20th week of growth and had heavier shoots and more leaves than plants grown under Gro-Lux alone.

These results suggest that African-violet fanciers should consider experimenting with light sources, mixing incandescent and fluorescent light. Generally speaking, the same conditions given for gloxinias should be provided for African-violets, with the exception of intensity. African-violets can be grown at lower light intensities than gloxinias.

Tuberous Begonias

Tuberous begonia plants also do well if grown under artificial light. These plants are especially responsive to the length of

the photoperiod. Long-day treatment is required to make them bloom. Under short days, the terminal shoot of the plant becomes dormant and growth ceases. This dormancy will continue until naturally occurring longer days of spring—at which time the plants will begin to grow again.

When plants have been growing under long-day conditions and then are placed under short-days, the process of tuber formation takes place.

The critical day length for *camelliaflora* types of the tuberous begonia is between 12 and 14 hours. For the *multiflora* types the critical day length is between 11 and 12 hours. At day lengths shorter than these, the plants will neither grow nor bloom. If they have been growing and flowering well and then are changed to shorter photoperiods, they will stop growing and form tubers. This is good to know in case one wants to switch to growing another kind of plant, and give the begonias a rest.

Long-day conditions may also be provided by giving the plants an interrupted night. For example, during the shorter days of winter, using 10 to 25 foot-candles of incandescent light from 10 P.M. to 2 A.M., in addition to providing 12 hours of light during the day, will cause the plants to continue to bloom.

For maximum tuber formation by the plants, the best temperatures were found to be either 60° or 80° F. The use of 70° F resulted in reduced growth.

In evaluating the growth of the three flowering plants under artificial light sources, it would certainly seem that they are compatible under the same or closely similar conditions. The minor difference shown by the tuberous begonia consists only of a cessation of growth and accompanying tuber formation under short photoperiods.

Other Sources of Information

- Boodley, J. W. 1963. New York State Flower Growers Bulletin 214.
 Hanchey, R. H. 1955. American Society for Horticultural Science. Vol. 66, pages 378-382.

THE RESPONSE OF PLANTS TO VARYING PERIODS OF LIGHT AND DARKNESS

Growth, flowers and fruits of many plants are affected by controlling their exposure to light and dark periods

R. Milton Carleton

WHEN plant scientists talk about the photoperiod, they are referring to the length of time during 24 hours when plants are exposed to periods of light and darkness. The two government scientists, W. W. Garner and H. A. Allard, who discovered that plants could be made to flower out of season by changing the length of day, classified the reaction of plants to light into three groups.

One group of plants requires long days to begin flowering; such plants are called *long-day* plants (China-aster is an example). A second group is composed of plants which must have shorter days if they are to bloom. They are called *short-day* plants. (Poinsettia and chrysanthemum are well-known examples). The

third group of plants is not sensitive to the photoperiod and bloom regardless of day length. They are termed *indifferent* (African-violets are examples).

Importance of Dark Period

Actually, subsequent investigations proved that it is not the length of day which affects growth, but the duration of the dark period which follows.

By breaking this dark period of 12 to 14 hours' duration into the shorter nights, each 5 to 10 hours long, short-day plants have been prevented from flowering.

The fairly simple divisions of three groups of plants mentioned above, however, must be extended to include other

J. Horace McFarland

The chrysanthemum is an example of a short-day plant and must be subjected to shorter periods of daylight to produce flowers.



responses to the photoperiod. For example, the Lady Washington geranium, *Pelargonium domesticum*, and Canterbury bells, *Campanula medium*, refuse to bloom unless first exposed to short days, followed by a period of long days. They are called short-day-long-day plants, usually simplified to short-long-day plants or SLD. Some varieties of clover respond to day length in the same way.

June-bearing strawberries have a reverse pattern, that is, they produce flower buds during short days, but the buds need long days to open and set fruit.

Effect of Temperature

Temperature also enters into the picture. If temperatures are 55° F, or below, but above freezing, strawberry plants will set buds in spite of long days, but if thermometer readings go above 65° F, they will only set buds on short days. Chrysanthemums will refuse to set buds even on short days if temperatures are 50° F or lower but, at 60° F, will do so.

Further complications in plants occur where the day length is not an absolute control over flowering. Although some species do have an absolute sensitivity, others do not. Those plants which do need a specific period of exposure to short or long days are known as obligate long or short day plants. In other plants, exposure to a given length of photoperiod may hasten or delay flowering: these plants are called facultative. Sensitivity to length of photoperiod is also affected by the age of the plant. For example, petunias are quite sensitive when young, but as they get older, become facultative or indifferent.

The effect of photoperiod and/or red light on dormancy in woody plants is discussed elsewhere (see page 23). However, some herbaceous plants, notably the strawberry, are also affected in a similar manner by day length.

Vegetative reproduction in some plants is controlled by day length. Again, the strawberry is an example. Runner formation is accelerated by long days, retarded by short. The tillering of grasses, so important in establishing a thick turf, is

also favored by long days. Plants of living leaf, *Bryophyllum pinnatum*, form new plantlets along the edges of old leaves during long days.

Extending the Photoperiod

One practical application of our knowledge of photoperiodism is to extend the day length during winter of plants growing under glass. Stocks, *Mathiola incana*, can be made to flower sooner by extending the light period approximately four hours. A light source strong in the red end of the spectrum is far more effective than white fluorescents for this purpose. The same is true of pansies and China-asters.

Shortening the Photoperiod

The classic use of growth control through manipulation of day length is shown in the flowering of chrysanthemums. Up to about 1955, this was accomplished by supplying enough additional light to extend the photoperiod to equal that of summer days during which chrysanthemums make only vegetative growth. Then when they were to flower, artificial illumination was cut off and the plants set buds, if, as already mentioned, greenhouse temperatures were above 50° F. Bringing this plant into blossom when days were too long to permit normal bud setting was accomplished by shading the plants with black cloth to produce a longer night period.

Present-day practice in lengthening the day has changed from the former method of simply extending the day to one of shortening the night by a "night-break"—a relatively low-intensity light period given during the dark period. This has the advantage, in commercial practice, of reducing the cost of lighting, since this interruption of the normal rhythm of growth for some reason requires much less intense light.

In the case of the poinsettia, a short-day plant, as little as two- or three-foot candles are just as effective as greater light intensity in artificially lengthening the day.



Generous

Temperatures, as well as day length, determine when the Christmas cactus blooms.

Interrupting Nightly Light Periods

Further studies have shown that the light periods at night need not be continuous. Short bursts of light energy spaced through the night are now being used to effectively change the photoperiodic response with a consequent saving in costs. Although cyclic lighting is perhaps too sophisticated a system for amateur use, a single night-break, using a time clock to turn the lights on for a time, then turn them off, is perfectly feasible.

An interesting application of light and dark periods exists in the flowering of poinsettia plants for Christmas. As a short-day plant, the poinsettia can be kept from flowering in a room where lights are left on during the night. When saved from one Christmas to another, thousands of such plants have proved an irritation to plant lovers, but by simply placing the plants in a dark closet at

night, they can be brought into flower.

Another holiday problem is the Christmas cactus. It is a facultative short-day plant. If grown at 55°F, it will flower in spite of long days, but at 65°F, it becomes an obligate short-day plant and can only be brought into flower if the day is shortened as in the case of the poinsettia.

Red and Far Red Effects

What has just been said about the photoperiod may become ancient history, if the effects of red and far red radiation recently discovered can be applied to plant growth in commercial and amateur practice! The interplay of red on the orange portion of the spectrum with the deeper far red energy (*i.e.*, light that is close to becoming invisible heat)—can produce all the results of the photoperiod, with much less expenditure of energy.

(Continued)

The Response of Plants to Light and Darkness (continued)

PLANTS SENSITIVE TO THE PHOTOPERIOD

As might be expected, most of the experimental work with accelerating or delaying flowering of plants has been with greenhouse crops of commercial importance. However, in efforts to find new crops for this purpose, many different species have been tried which did not prove profitable. Information on these

specialized crops is included below for the occasional amateur who looks for such information, often in vain.

Anyone who has tried, for example, to find out whether a crop such as pansies or delphiniums could be forced for a flower show at a given date will appreciate a record of past efforts.

Antirrhinum majus (Snapdragon)—Varieties forced for winter flowers in the greenhouse are considered indifferent to the photoperiod, but summer-flowering garden types are accelerated in flowering if given continuous light for the first three to six weeks of seedling growth. Even if subjected to short days at maturity, the effect persists. Degree of acceleration depends on variety.

Begonia (various)—The bedding or wax begonia, *B. semperflorens*, is indifferent to the photoperiod and will flower the year around, provided that it is not exposed to temperatures above 70° F on short days. The 'Elatior' and 'Gloire de Lorraine' types are short-day plants with an odd exception. 'Elatior' types remain vegetative on long days (14 hours or longer), producing flowering buds at 13½ hours and flowers in the fall. If, however, daylight drops to 11½ hours, they become dormant, resuming growth the following spring. Obviously, careful control of light is necessary if they are to flower for a special date. 'Gloire de Lorraine' and the so-called Scandinavian varieties are truly winter-flowering on short days. To delay flowering, start long-day periods in October. Cuttings taken from these plants from April on and grown for a year, are used as stock plants. Terminal cuttings from the stock plants, taken in early July, will flower for Christmas. By giving them a 14-hour day from October until January 15th, then normal winter light, they will flower for Mother's Day or Easter. This is hardly a project for the amateur's small light unit, but in a home greenhouse some out-of-the-ordinary specimens for display can be produced. Light effects on tuberous begonias are described on page 39.

Bromeliads—Although flowering is controllable by the photoperiod (and this method is used in Europe) the present-day practice in the United States is to employ a ripening apple to generate ethylene gas, which stimulates flower bud formation. *Aechmea fasciata* and some *Billbergia* species are long-day plants and artificial light for four hours in addition to daylight has produced winter bloom in Europe.

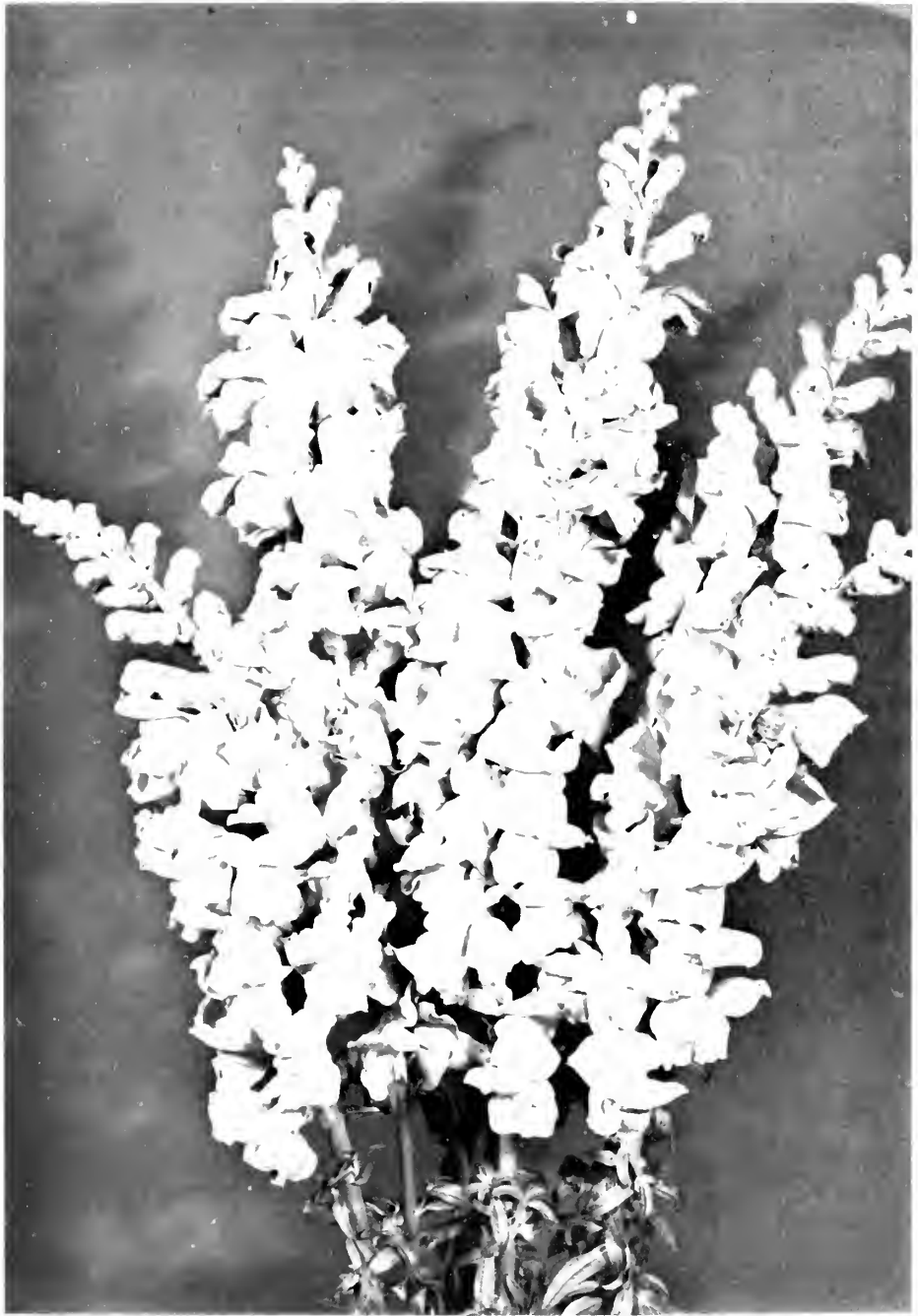
Calceolaria—Temperature, rather than day length, affects flower bud formation. A temperature of 50° F is optimum. Once buds have been set, however, a 14-hour day will speed flowering.

Callistephus chinensis (China-aster)—This species is quite sensitive to low light intensities, allowing it to be grown as a field crop in California under overhead lights. Details of forcing are quite complex. Those interested in forcing this plant for flower shows or other purposes would do well to refer to *Florist Crop Production and Marketing* by Kenneth Post.

Campanula medium—The striking Canterbury bells has already been mentioned as a plant which must be subjected to short days, then long days for flowering. In Holland, it is forced by the following method: Seed is sown in March, potted in 8- to 10-inch pots and grown until a rosette is formed; then planted in benches in the greenhouse in August, grown under short days until mid-October, then given 14-hour days. The plants flower in December and January. If they are needed for a spring flower show, continue short days until mid-December.

Campanula isophylla—If given a 14-hour day from October 1st on, this lovely "Star of Bethlehem" will flower during the winter. Cuttings taken from these plants grown under lights will root faster than those from plants on short-day cultivation.

Centaurea cyanus—This modest annual cornflower proved a challenging problem in personal attempts to force it for flower shows. Unless first given six weeks at 50 to 55° F on short



Generous

Snapdragons, forced for winter cut-flower use, are indifferent to photoperiod, but garden varieties bloom earlier when given continuous light in the seedling stage.

days, the plants would shoot up to single stems, flower, and die. Given this short-day treatment, they would produce basal branches. If then put on a 14-hour day, they would produce a bushy plant covered with flowers. Once the first buds showed color, exposing them to short days would slow up growth, but not check flowering.

Cineraria (*Senecio cruentus*)—Follow the same treatment as for *calceolaria* in lighting for this plant.

Chrysanthemum—The florist's chrysanthemum has been the subject of such intensive study that even a summary is impractical. The interplay of light and temperature affects varieties so differently that without one of the elaborate charts published by producers of chrysanthemum cuttings, no specific recommendations can be made. For amateur culture, a simplified schedule might call for lighting after August 15th to hold back plants for winter bloom, then giving short days (12 hours long) about 35 to 40 days before bloom is wanted. Temperature should be 60° F or buds may not form. To speed up flowering, days must be shorter than 13 hours. Over most of the United States, this will mean that light-tight black cloth or other means of shading will have to be put over the plants from April 1st to August 15th when flowering chrysanthemums are out of season. (For *Chrysanthemum parthenium*, see feverfew.)

Coleus blumei—About the only need for using lights on this plant is to prevent elongation in dark weather.

Dahlia—Personal experiences in forcing this plant for various flower shows in the Chicago area have been both frustrating and rewarding. Despite its reputation as a short-day plant, flowering in fall, it has been found to be a long-day plant for flower bud formation. If given short days under lights, it merely forms tubers and blooms fitfully. It must have a 14-hour day, at quite high light intensities (about 1,000 foot candles) in order to bloom well. Even then, some varieties will stretch.

Delphinium—Perennial plants, bunched in November, grown at 50° F and lighted 14 hours, gave satisfactory bloom for a mid-March show. Annual larkspur, sown in October and grown at 50° F until December on short days, then lighted 14 hours with the temperature not over 55° F, were equally satisfactory.

Dianthus (Carnation)—Although not commercially too important, lighting for the carnation and other members of the *Dianthus* genus to provide a 17-hour day will force flowers to develop faster.

Euphorbia pulcherrima (Poinsettia)—Must have 60 days of short days (less than 12 hours) to set buds and form colored bracts for Christmas. To prevent too-early formation of bracts (resulting in weak flowers), it is well to give them high illumination up to the beginning of the critical 60-day period. A novel use for lights on white forms of poinsettia is to light them up to two months before Easter, then give them short days.

Feverfew (*Chrysanthemum parthenium*)—Four to five hours of additional light substantially speeds flowering and quality of winter bloom. Ten-foot candles from Gro-Lux fluorescent tubes are enough for this purpose.

Fuchsia Hybrids—While sensitive to the photoperiod, lighting this group of plants is tricky. If given four long days during late October, they can be flowered for Christmas. However, if long days (14 hours or over) are continued much beyond that length, fewer flowers will be produced. Reduction to 12 hours after the four-day initial treatment will give better results. A temperature of 60 degrees will be needed to prevent bud drop experienced at lower readings.

Gaillardia—In forcing the annual gaillardia for flower shows, flowering was advanced between two to four weeks by 14-hour days. Flower quality was improved.

Kalanchoë blossfeldiana—When grown from seed, the use of a 16-hour day will produce better seedlings during winter months. Once a fifth pair of leaves has been formed, the plants can be made to flower by giving them short days (less than 12 hours, down to 9½ hours).

Lathyrus odoratus—See sweet pea.

Marigold (*Tagetes*)—Although theoretically indifferent to day length, the variety Lieb's Winter Flowering was selected for its ability to flower in winter. Although other varieties and species will flower on a 12-hour day, more laterals will be formed, with more flowers, on a 16-hour day.

Mathiola—See stocks.

The cineraria (right) is more influenced by temperature than the photoperiod in setting buds. However, once buds have formed, flowering is hastened by increasing the daylength. The Christmas or 'Gloire de Lorraine' begonias (below) are short-day plants.



Photographs by Genereux



Pansy (*Viola*)—Short nights, produced by giving the plants a burst of not less than 200-foot candles for half an hour during the night, will increase the number of flowers produced during winter months from five to ten times. Plants will respond better if given cold treatment for four or five weeks before forcing.

Pelargonium—Both the Lady Washington and florist-type geraniums respond to photoperiod control as described under *Campanula medium*.

Petunia—As already mentioned, petunias are only responsive to photoperiod control during the first seven weeks of growth from seed. By growing them under short day culture for several days, a rosette is formed, producing a more compact plant. After this treatment, normal light will force flowering.

Phlox drummondii—For annual phlox, temperatures above 70° F, with a day-length of 14 to 16 hours, are needed to stimulate flowering.

Primula malacoides (Fairy Primrose)—At temperatures below 60° F, this greenhouse plant is indifferent, but at 60° F and up, it is a short-day plant. Kenneth Post at Cornell worked out an interesting method for producing a continuous supply of plants for the florist trade. By keeping the plants at 60° F on long days, he could then place small batches wanted for sale into a greenhouse with short days 10 weeks before needed. The temperature on short days was 50° F.

Rudbeckia (Annual Coneflower)—Its only successful forcing for a flower show required continuous light at 600-foot candles. Two previous efforts failed at shorter photoperiods and lower light intensities. Plants were grown in a greenhouse, supplementing daylight at night with white fluorescent tubes plus incandescent lights.

Saintpaulia (African-violet)—See page 39.

Salpiglossis sinuata—Sown in September, this plant responded to the same treatment as *Rudbeckia* and flowered for a March show.

Salvia splendens—A complex photoperiod response makes it difficult to over culture under lights briefly. There are differences between varieties which mean working out day-length response for the particular variety being forced. Personal experiences were with varieties no longer in commerce. At the University of Wisconsin, it was found that plants would flower on short days at 70 to 75° F, but not on long days. At 55° F, the varieties tested were indifferent to day length and flowered on either short or long days. Response at 63-65° F was the same as at 70° F.

Scabiosa atropurpurea—This annual *scabiosa* flowered for a March show from seed sown in October, with normal winter daylight supplemented with 600-foot candles of fluorescent tubes plus incandescent lights from 4 P.M. to 10 P.M. at 55 to 60° F.

Schizanthus—Except for the requirement of a lower temperature to prevent stretching, the response is the same as that of *scabiosa*.

Stephanotis floribunda—By using standard Gro-Lux tubes from October 1st on, a vine in bloom remained so until Christmas. Lights went on at 4 P.M.; off at 10 P.M.

Stocks (*Mathiola incana*)—Temperature is more important than day length, except that the newer Trysomic varieties (on which no data seems to be available under lights) might not be as sensitive to higher temperatures. Flower bud initiation is optimum at 55 to 60° F. Long days stimulate bud set. At Ohio State, Kiplinger found that August-sown seed will produce flowering plants for Christmas under long-day culture.

Sweet Pea (*Lathyrus odoratus*)—Winter-flowering varieties, which flower on short days make research under lights of little value. When forced with supplemental lighting, summer-flowering types are of poor quality unless unusually high light intensities are used. A temperature of 60° F is needed.

Zygocactus truncatus (Christmas Cactus)—As ordinarily grown in the house, where room temperatures are usually above 70° F, this acts as a short day plant and will not set buds if the room is artificially lighted at night. At temperatures below 50° F, it will set buds either on long or short days. To set buds for Christmas—unless kept in a room where no artificial lights are turned on at night—best treatment is to put the plant in a dark closet about 6 P.M., starting October 1st, and bringing it out into the light the following morning. For later blooming, hold the plants at temperatures above 70° F and do not fuss about exposure to lights at night. About two months before flowers are wanted, start the dark closet treatment. In the fall where frost does not threaten, the plants can be left out-of-doors to expose them to cooler temperatures to flower before Christmas.

Response of Plants to Light (continued)

Food Crops

Tomato—The familiar ad showing an enormous tomato plant growing in a closet is of course an all-but-impossible dream. At the same time, artificial light can play an important role in growing this crop. In England, where winter light intensities are low, fluorescent tubes or mercury-vapor lamps are used to irradiate tomato seedlings. Seeded in early December, the irradiated plants are benched in February. British varieties seem to tolerate lower temperatures than those grown in America. If our varieties were grown at the temperatures of 54-55°F the British use, flower bud drop would be excessive. In Holland, neon lights are used. In both countries, it has been found that if plants receive less than seven hours of darkness, they become chlorotic. Plants under fluorescent tubes seem less subject to this disorder. In Sweden, Belgium and Russia, mercury lamps of high wattage (400 watts) are preferred because of their higher light output. See also page 27.

Cucumber—Both fluorescent tubes and mercury lamps are used abroad to supplement natural daylight for five hours or more. Cucumbers will tolerate continuous light, but little is gained beyond five hours. Because cucumbers do not mind heat, high light intensities, with tubes close to the plants, are feasible.

The most important use of light is to give seedlings a quick start; most growers light them continuously for the first three to five weeks of growth.

Lettuce—Although lettuce is grown under artificial light without daylight, I personally find the finished product flabby and lacking the crispness associated with quality salad greens. Supplemental light is used widely in England, but in the United States, where winter sunshine is stronger, the extra cost of electricity hardly pays. Bibb lettuce is a satis-



Generous

Most foliage plants, such as the Boston fern, can exist under low light intensities.

factory crop to grow under lights and brings a premium price.

In home culture, it is difficult to provide high enough light intensity while still maintaining the cool temperatures lettuce prefers. A new variety worth studying (grown only once in personal tests—it was only introduced in 1970) is Chesibb, developed by Michigan State University. It is a cross with one of the British Chestnut varieties and Bibb. In a personal test, this formed heads at 800 foot candles on each 15-hour day. Timing and intensity were probably not optimum, and the temperature was too high. Far red light may play a part in lettuce growth under lights.

Strawberries—Because of the ease with which strawberries can be shipped North from Florida and Louisiana, practically nothing has been done to test growth under lights in the United States. In Europe, strawberries are forced with supplemental light to supply a 16-hour day, after a low-temperature period ranging from 42 to 55°F to set flower buds. Lights go on to supplement daylight in mid-October, producing fruit for Christmas. Amateurs might want to try this, using either Alpine varieties, such as Rugen or Baron Solemacher, or June-bearing varieties. There is no information available, as far as is known, on the effects of supplemental light on everbearing varieties.

(Continued)

Response of Plants to Light (Concluded)

Light Requirements of Foliage Plants

A tremendous increase in the use of foliage plants for interior decoration has brought about a need for more accurate information on their light requirements. So far, practically no work has been done on daylength duration. The figures given below assume a normal day with intensities listed being experienced at noon, with less light usually towards evening and in the morning.

Where artificial lights are needed to supplement daylight, fluorescent tubes are

often impractical, since light they give off does not "project" well and the tubes must be placed a few inches above the foliage. Fortunately, foliage plants are not expected to flower and so light spectrum is not too important. Incandescent bulbs seem to do a satisfactory job.

Research is needed in combinations of light quality, intensity and photoperiod for optimum growth, but in the meanwhile, the following information should serve as a guide.

Plants needing high intensities—They must have full light all day—from dawn to dusk—with no obstructions to shade window. They prefer 5,000 to 8,000 foot-candles, but will tolerate 1,000 to 2,000 foot-candles for a 12-hour day.

Aloe variegata
Beaucarnia recurvata
Cissus quadrangularis
Codiaeum (various)
Crassula arborescens
Euphorbia (various)
Ficus exotica
*Ficus pandurata**
Gynura aurantiaca

*Hedera helix**
Hibiscus rosa-sinensis
Homocladium platycladum
Hoya (various)
Kalanchoë (various)
Pedilanthus tithymaloides
Pelargonium hortorum
*Rhoeo discolor**
Sansevieria (various)*
Schefflera actinophylla

*Indicates that these plants can also tolerate medium intensities.

Plants for medium intensities—For lightly shaded windows. To test intensity, pass a hand over the plant. If shadow of hand shows, but outline is slightly diffused, light is about right. These plants prefer 1,000 to 4,000 foot-candles for normal day, but will tolerate 500 to 1,000 foot-candles for 12-hour day.

Acanthus (various)
Aglaonema modestum
Begonia rex
Caladium bicolor
Chlorophytum elatum
Cissus antarctica
Cissus erosa
Cissus rhombifolia
Costus speciosus
Dieffenbachia (various)
Dracaena (various)

Ficus (various)
Ligularia kaempferi
Pandanus (various)
Peperomia (various)
Philodendron (various)
Piper ornatum
Polyscias balfouriana
Ruellia makoyana
Sanchezia nobilis
Scindapsus aureus
Syngonium (various)

Plants for low intensities—No strong, direct light source. They prefer 100 to 500 foot-candles for normal day, but will tolerate 75 to 100 foot-candles for 12-hour day.

Aglaonema (various)
Ferns (various)

Ficus elastica
Ficus macrophylla



Arthur Norman Orans

Exhibit of Metropolitan Chapter of the Society at 1970 International Flower Show.

THE INDOOR LIGHT SOCIETY

*Mecca for specialists who
grow plants under lights*

WHEN interest in one phase of horticulture moves into specialization, the result is the founding of a society—and growing plants under artificial light is not an exception. The Indoor Light Gardening Society of America, Inc., was started in 1965 and has since become an organization of hobbyists as well as scientists, professional horticulturists and lighting engineers. One of the benefits of membership is a bimonthly bulletin, which contains news of lighting research at universities and experiment stations as well as on amateur projects. Membership costs \$4 a year. For information, write to Mrs. Fred D. Peden, 4 Wildwood Rd., Greenville, S. C. 29607. Information on the Metropolitan chapter of the Society may be obtained from Ed Grasheim, 255 W. 88th St., New York, N.Y. 10024. ♦

ELECTRIC LIGHT SOURCES FOR PLANT GROWTH

Christos C. Mpelkas

LIGHT supplies energy to plants and, in the process of photosynthesis, converts it into useful forms of chemical energy, in turn, is used to build up complex chemical constituents, notably carbohydrates which both plants and animals require. As has been explained elsewhere in this Handbook, photosynthesis is probably the most fundamental process in plant life.

Basically, light of two wavelengths which have distinctive absorption bands in the blue, 440 millimicrons (mm)* and red, 660 millimicrons (mm) regions of the spectrum, is required to activate the photosynthetic process.

Recently, plant scientists of the U.S. Department of Agriculture, working at Beltsville, Maryland, have discovered a growth-triggering chemical which governs growth changes in plants. This chemical is a protein that acts as an enzyme, enzymes being chemical substances produced by living cells which accelerate chemical reactions without themselves undergoing marked changes in the process. It is a blue-green pigment called "phytochrome." In a broader sense, phytochrome may also be regarded as a plant growth regulator.

It occurs in two reversible forms: one form absorbs red light at a wavelength of 660, the other at 735. The light at 735 is at about the limit of red light that is visible to the human eye, and is referred to as far red light. The red portion produces optimum growth response

of green plants, and the far red is capable of reversing the action of the red. In fact, researchers indicate that this photochemical reaction may be the master control mechanism for plant development, because it directs the plant's progress from one stage to the next. Acting as an enzyme, it controls the germination of seeds, root growth, shoot growth, leaf expansion, and anthocyanin pigment formation. It measures the length of day, or more correctly, the length of the night required to induce flowering (photoperiodism), or places the plant in a state of dormancy that enables it to survive the winter.

Research studies have shown that when light at 700, or at slightly longer wavelengths, was added to light at 650, the photosynthetic activity was considerably greater than the effect of the two kinds of light energy acting independently. This phenomenon is now known as the Emerson enhancement effect, which resulted from the experiments conducted by Robert Emerson and his colleagues at the University of Illinois. Further studies have shown that blue light at a wavelength of 420 enhanced the effect of the red light at 650.

The enhancement effect is aided by accessory pigments which transfer light energy to chlorophyll in the photosynthetic process. There is recent evidence that photosynthetic enhancement may be due in part to the properties of a far red absorbing form of chlorophyll.

Light Sources for Plant Growth

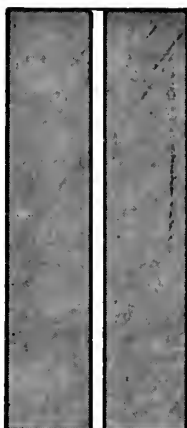
The purpose for using light sources for plant growth is to duplicate the growth responses induced in plants by sunlight, but not necessarily to duplicate the sun in its intensity or spectral emission. This is

*Also called nanometers (nm). A nanometer is a measure of wavelength of light. Visible light extends from 380 nm (violet) to 760 nm (deep red light). See also page 25.



INCANDESCENT LIGHT SOURCE

PRODUCES NON-UNIFORM LIGHT DISTRIBUTION WITH HIGH AND LOW LIGHT AREAS-HOT SPOTS DIRECTLY UNDER LAMPS....



FLUORESCENT LIGHT SOURCE

MAINTAINS MORE UNIFORM LIGHT DISTRIBUTION ON ALL PLANTS....

accomplished by the use of those light sources which provide both the intensity and spectral emission most effective for the response desired.

Other factors to be considered when selecting man-made light sources for plant growth are energy conversion efficiency, rated life, uniformity of light distribution, economic operation, and maintenance.

Various conventional light sources have been experimentally evaluated for their ability to produce growth, or growth responses of plants at energy levels much lower than that produced by full sunlight during the natural growing season. This is a very essential requirement in the economic application of light sources for research studies, commercial installations, and amateur indoor gardens. On an equal wattage basis, the fluorescent lamp is more efficient than incandescent bulbs because it is approximately three times more effective in converting electrical energy into light energy. The general

purpose incandescent lamp has an energy conversion efficiency of only 6 to 8 per cent, whereas the energy conversion efficiency of the fluorescent lamp ranges from 20 to 24 per cent. Moreover, the fluorescent lamp has about fifteen times the life of an incandescent lamp. Thus, an economic gain is realized. And it should be pointed out that the linear fluorescent lamp maintains a more uniform light distribution on plants than does the incandescent. In general, incandescent lamps produce hot spots directly under lamps and low levels of light between. (See accompanying diagram.) Fluorescent lamps are therefore more ideal for plant growth because they give off more light, last longer, operate at a lower temperature, and partially suppress internodal elongation of plants. By burning cooler, fluorescent lamps can be placed closer to plants, thus providing higher light intensities without damaging plant tissue.

Research studies have shown that plants requiring relatively low light in-

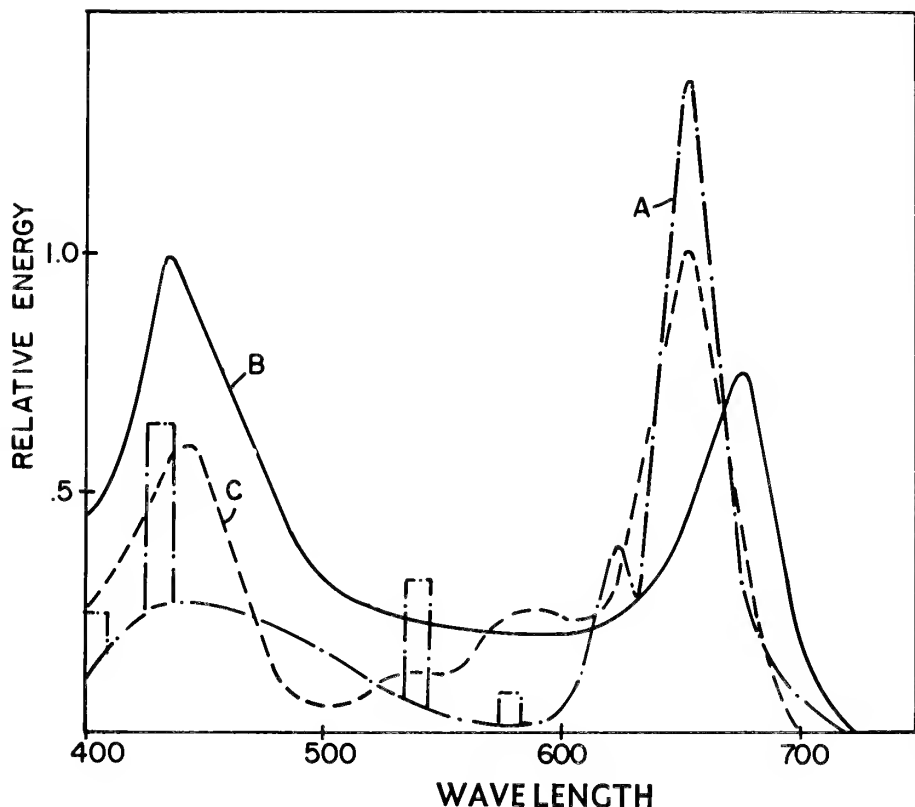


Figure 1. Comparison of the action spectra of two principal plant photochemical reactions with the Gro-Lux lamp. A—SED Curve of the Gro-Lux fluorescent lamp; B—Photosynthesis Curve, and C—Chlorophyll Synthesis Curve.

tensities, such as many favorites grown indoors, principally use two wavelength regions of the spectrum, the bands of red (600—700) and blue (400—500). In contrast, vegetable crop plants and flowering plants grown for florists generally use three wavelength regions, far red (700—800), red (600—700), and blue (400—500), to produce normal growth of leaves and stems, and to induce flowering.

Recently, special plant-growth fluorescent lamps have been developed that produce the greater portion of their light energy in these regions. Thus plant growth is favored because most of the energy emitted is absorbed by plant pigments. The evidence presented in the literature on the performance of plant-

growth lamps appears to be in favor of their use over conventional lamps for the growth of many species and varieties of plants. The use of such special fluorescent lamps has increased quality, yields, and has shortened the time from planting to marketing.

At present, several different plant growth lamps are marketed in the United States. They include the Standard Gro-Lux, Plant-Gro, Plant Lite, and Plant Light fluorescents. These lamps are intended primarily for the growth of such plants with low-energy requirements as African-violet, gloxinia, and foliage plants which utilize chiefly the red (600—700) and blue (400—500) bands of the spectrum. The emission of these lamps is

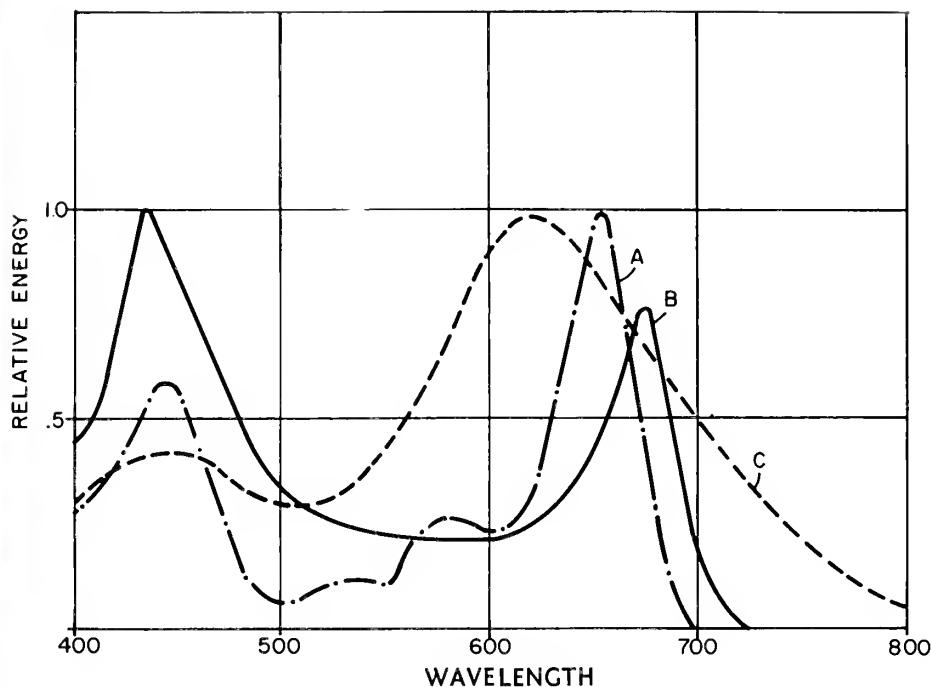


Figure 2. Comparison of the action spectra of the two principal photochemical reactions with the Wide Spectrum Gro-Lux. (A) Chlorophyll Synthesis Curve and (B) Photosynthesis Curve, (C) SED Curve of Wide Spectrum Gro-Lux fluorescent lamp.

illustrated in Figures 1 and 2, in relation to the action spectra of two principal plant photochemical reactions, chlorophyll synthesis and photosynthesis. Apart from the direct influence of such lamps on plant growth, they are very effective for lighting displays of flowering plants. The unique red and blue radiation from the lamps enhances the appearance of most plants.

A new plant growth lamp source has been designed, utilizing knowledge of the most recent studies in photosynthetic enhancement and phytochrome response. This is the Wide Spectrum Gro-Lux fluorescent lamp, which radiates energy in the far red (700–800), red (600–700), and blue (400–500) regions of the spectrum. The far red emission from the Wide Spectrum Gro-Lux lamp now makes it unnecessary to supplement

fluorescent lighting with incandescent lamps. Figure 2 compares the spectral energy distribution curve of the Wide Spectrum Gro-Lux lamp with the photosynthesis and chlorophyll-synthesis action spectra curves. This lamp may now be used alone to fulfill the complete requirement for the growth of economic crop plants that require high light energy. As indicated in Table I, there are a number of photochemical processes that are important in higher plants, including the numerous photoreversible reactions (red, far red responses).

Conventional Cool White fluorescent lamps (supplemented with incandescent bulbs) are commonly used for plant growth, though they were never designed for maximum plant growth response. The Cool White fluorescent was designed for visual use. It radiates most of its energy

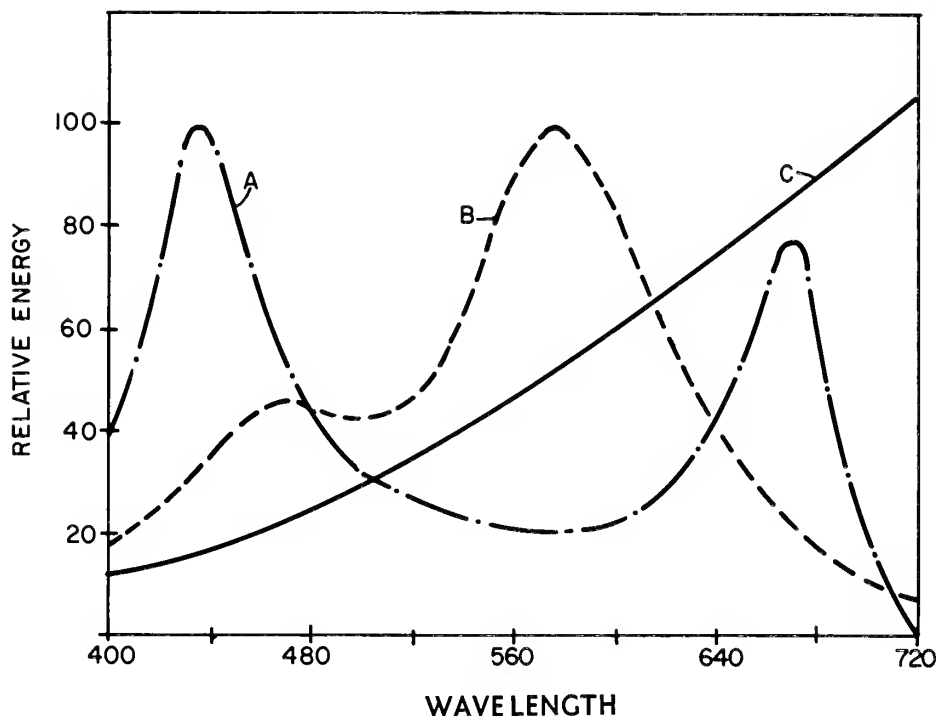


Figure 3. Comparison of the action spectra of (A) Photosynthesis Curve with the SED Curves of (B) Cool White fluorescent and (C) incandescent lamps.

in the yellow-green (500—600) portion of the spectrum, a portion of low photosynthetic response, as illustrated in Figure 3. On the other hand, the incandescent lamp radiates very little blue light, a necessary ingredient for photosynthesis. However, the combination is more suitable for plant growth than either used alone.

Measurement of Light Energy

Since radiant energy for plant growth is not the same as visual illumination for the human eye, the foot-candle as a unit of measurement of radiant energy for plant responses has limitations. The foot-candle is based upon the spectral sensitivity of the human eye; it is wavelength selective with the maximum response from 550 to 560, as shown in Figure 4. However, the foot-candle meter can be a very useful tool in establishing intensity levels and uniform distribution of light

over plants from light sources such as have been described here in terms of their spectral emission.

Instruments for measuring light energy in absolute units are essential for scientific work with horticultural lighting and include such devices as the thermopile, bolometer, and spectroradiometer. These instruments have a linear response within a wide energy range and over a broad wavelength band. The spectroradiometers range from portable plant growth photometers, which measure energy in absolute units ($\mu\text{w}/\text{cm}^2$) for the three major spectral response regions previously mentioned (400 to 500, 600 to 700, and 700 to 800), to stationary laboratory types which measure radiant energy from the ultraviolet through the infrared spectral regions. For practical considerations, it is usually more convenient to express light intensity for commercial horticultural lighting in terms of lamp watts per

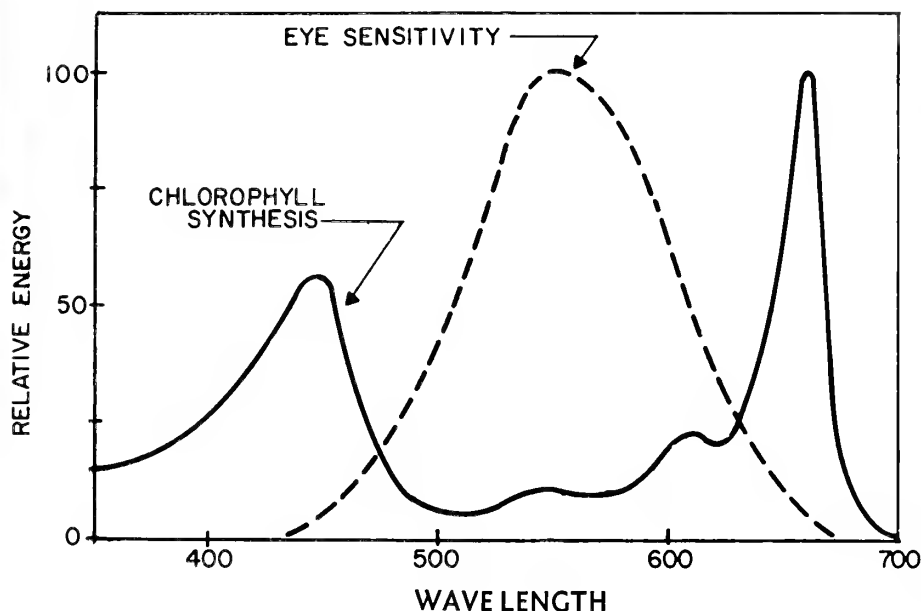


Figure 4. Spectral activity of the chlorophyll synthesis process. The visual sensitivity curve has been shown for comparison.

square foot of growing area—with the light source at a given distance from the plants. This enables the plantsman to determine the number of lamps needed for a particular area and the power used.*

Other advantages of using lamp watts per square foot include:

1. Greater accuracy than that of a foot-candle reading for comparing lamps of different spectral energy distribution curves.
2. Simplified calculations in the cost per square foot for installation and operation of a lighting system.

Applications

In horticultural lighting there are two general categories of applications. They are the photosynthetic and photoperiodic lighting systems.

*The formula for calculating the number of lamps for an installation is:

$$\text{Number of lamps} = \frac{\text{Growing area} \times \text{lamp watts/ft.}^2 \text{ required}}{\text{Individual lamp watts}}$$

The photosynthetic system utilizes light sources to provide part or all of the light necessary for photosynthesis and normal growth of plants. For many plants the quantity of light for photosynthesis may range from 10 to 100 times greater than that required for control of flowering (photoperiod). Photosynthetic lighting has its use in greenhouse applications to supplement natural light. These conditions are prevalent during the fall, winter, and spring seasons, and are limiting factors in the growth of greenhouse crops. Depending upon the crop, the range of supplemental light energy levels may range from a low of approximately 100 microwatts per square centimeter ($100 \mu\text{w}/\text{cm}^2$) or 5 watts per square foot ($5\text{w}/\text{ft.}^2$) to 400 microwatts per square centimeter ($400 \mu\text{w}/\text{cm}^2$) or 20 watts per square foot ($20\text{w}/\text{ft.}^2$) or higher.

Greenhouse applications include over-bench and overbed lighting applied before dawn or dusk to extend the natural photoperiod (daylight extension), light-

(Continued)

TABLE I
PRINCIPAL PHOTOCHEMICAL REACTIONS OF HIGHER PLANTS*

<i>Photoprocess</i>	<i>Reaction or Response</i>	<i>Products</i>	<i>Photoreceptors</i>	<i>Action spectra peaks (mμ)</i>
Chlorophyll Synthesis Photosynthesis	Reduction of Protochlorophyll	Chlorophyll a	Protochlorophyll	Blue: 445
	Dissociation of H ₂ O into 2(H) and ½ O ₂ and reduction of (CO ₂)	Chlorophyll b Reductant (H) Phosphorylated compounds	Chlorophylls Carotenoids	Red: 640 Blue: 435 Red: 675
Blue Reactions	(1) Phototropism	Regulation of Growth Oxidized auxin, auxin systems and/or other components of the cell	(1) Carotenoid and/or flavin (2) Unknown (3) Pyridine nucleotide, riboflavin, etc. Phytochrome	1. Near UV: 370 Blue: 445, 475 2. Uncertain 3. Uncertain
	(2) Protoplasmic viscosity (3) Photoreactivation			
Red, Far red Reactions	(1) Seed germination	Biochemistry completely unknown		(1-6) Induction by red: 660; reversal by far-red: 710 and 730 (7) Far red induced, red reversed, spectral details uncertain
	(2) Seedling & vegetative growth (3) Anthocyanin synthesis (4) Chloroplast responses (5) Heterotrophic growth (6) Photoperiodism (7) Chromosome response			

* From Withrow (1959).

TABLE II
THE REQUIREMENTS FOR PHOTOSYNTHETIC AND PHOTOPERIODIC LIGHTING

<i>Object of Lighting</i>	<i>Applications</i>	<i>Time Applied</i>	<i>Total Light Period (Hrs.)</i>	<i>Lamp (W./ft²)</i>	<i>Lighting Sources</i>	<i>Luminaires</i>
I. Photosynthetic						
A. Supplementary						
1. Day-length extension	a. Seed germination, seedlings, cuttings, bulb forcing	4 to 10 hours before sunrise and/or after sunset	a. 12 to 20	a. 5 to 20	Fluor. lamps @ various loadings with and w/o internal reflectors Wide Spectrum Gro-Lux Lamp as above as above	Moisture resistant fixtures of industrial or custom made designs with mountings fixed or adjustable providing minimum shading of sunlight & minimum interference with greenhouse routine
	b. Mature plants		b. 10 to 16	b. 10 to 40		
2. Dark day	as above	Total light period	as above	as above		
3. Night	as above	4 to 6 hours in middle of dark period	as above	as above		
4. Underbench	as above	Total light period	as above	as above		
B. Growth room						
1. Professional horticulture	Seed germination, seedlings, cuttings, bulb forcing	Total light period	12 to 20	5 to 30	Fluorescent lamps at various loadings. Combination of Standard and Wide Spectrum Gro-Lux lamps (1:1 ratio) as above	Industrial direct reflector fixtures which are moisture resistant and are mounted in a shelf arrangement
2. Amateur horticulture	Seed germination, seedlings, bulb forcing, mature plants, etc.	Total light period	10 to 24	5 to 30		
3. Experimental horticulture	All types of plant responses	Total light period	0 to 24	0 to 140	Fluorescent with 10-20% of installed watts, incandescent. Combination of Standard & Wide Spectrum Gro-Lux lamps (1:1 ratio)	Custom built with minimum spacing for maximum light output of lamps

(Continued)

TABLE II (continued)
THE REQUIREMENTS FOR PHOTOSYNTHETIC AND PHOTOPERIODIC LIGHTING

Object of Lighting	Applications	Time Applied	Total Light Period (Hrs.)	Lamp (W/ft ²)	Lighting Sources	Luminaires
II. Photoperiodic						
A. Supplementary						
1. Day-length extension	Prevent flowering of short-day plants	4 to 8 hours before sunrise and/or after sunset	14 to 16	.5 to 5	High or low pressure gaseous discharge fluorescent lamps	As for photosynthetic supplementary lighting
2. Night break	as above	2 to 5 hours in middle of dark period. Continuous or cyclic	14 to 16	.5 to 5	as above	as above

ing during dark, overcast days (dark-day lighting), and lighting for some time during or throughout the dark period (night-period interruption). Lighting placed under the benches (underbench lighting) uses the space between the bench and the floor, thus utilizing more of the available growth area without the expense of enlarging the greenhouse.

Although definite advantages can be obtained in the greenhouse with supplemental light alone, it is evident from experimental work that the benefits of the combination of both supplemental light and an enriched carbon dioxide atmosphere will be greater when used together at optimum temperatures than the benefits of either used alone. Carbon dioxide levels of 0.10 per cent to 0.20 per cent (1,000 p.p.m. to 2,000 p.p.m.) maintain optimum growth of many plants (For carbon dioxide enrichment of greenhouse air, see PLANTS & GARDENS Handbook on The Home Greenhouse.)

Environmental Chambers

For controlled environmental chambers or rooms for research, the Wide Spectrum Gro-Lux fluorescent lamps have proved satisfactory for growth responses of many plant species. Recently, studies have shown that a combination of the Standard Gro-Lux and Wide Spectrum Gro-Lux fluorescent lamps (1:1 ratio) improved plant production over the combination of conventional fluorescent and incandescent sources. With the use of fluorescent sources, a lower chamber temperature is maintained. High pressure lamps such as metal halide, mercury, and xenon lamps have been used. The light energy levels may range from 5,000 to 10,000 $\mu\text{w}/\text{cm}^2$ (300 to 800 mm) and above.

The propagation areas of commercial growers and plant hobbyists use fluorescent lamps installed at about ten watts per square foot (10w/ft.²) for growth of seedlings, rooting of cuttings, and forcing of bulbs. For the growth and maintenance of low-energy plants (indoor plants), 15w/ft.² have produced optimum results.

In the U.S.A. today, the greatest use of lighting in horticulture is in the control of photoperiod (see article on page 43) for the purpose of controlling the out-of-season flowering of certain species of economic plants which require specific light-to-dark periods for flowering. This knowledge is used to bring plants into bloom when there is a particular market advantage. Photoperiodic lighting is used to produce long-day responses for short-day or long-day plants in the greenhouse or field by extending the natural light period with continuous lighting beginning at dusk or before dawn (daylight extension), by interrupting the dark period with continuous light (night-period

interruption) or with intermittent light for two to seven per cent of the time period (cyclic or flash lighting). Incandescent, fluorescent, mercury and metal halide have been used for photoperiodic lighting, installed to provide about 5-10 foot-candles or 0.5 to 5 w/ft.². The general lighting requirements for the above applications are shown in Table II.

The application of radiant energy from electric light sources to control plant growth is just beginning. The number of applications in the research, commercial, and amateur field is rapidly increasing, and much remains to be learned about the use of proper light sources for the many potential applications in horticulture. ♦

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MATERIALS, PLANTS, BOOKS

Materials

Beverly J. Smith, Box 244, Route 2, Chittenango, N.Y. 13037. Fixtures, miniature plastic greenhouses, etc.

Environment/One Corp., 2773 Balltown Road, Schenectady, N.Y. 12309. Growth chambers with controlled environment.

Floralite Company, 4124 E. Oakwood Road, Oak Creek, Wis. 53154. Fixtures, supplies.

George W. Park Seed Company, Inc., Greenwood, S.C. 29646. Indoor gardening supplies; units. Sylvania Sunbowl. House Plant Corner, P.O. Box 121, Oxford, Maryland 21654. Fixtures, tubes, timers. Catalog 20 cents.

Lighting, Inc., P.O. Box 2228, Raleigh, N.C. 27602. Indoor garden lighting supplies.

Neas Growers Supply Company, Greenville, S.C. 29604. Tubes, fixtures, etc.

Radiant Color Company, Lifelite Division, 2800 Radiant Ave., Richmond, Calif. 94804. Reflectors.

Shoplite, 650 Franklin Ave., Nutley, N.J. 07110. Fixtures, plant stands, supplies. Catalog 25 cents.

Tinari Greenhouses, 2325 Valley Road, Huntington Valley, Pa. 19086. Fixtures, supplies.

Tube-Craft, Inc., 1311 W. 80th St., Cleveland, Ohio 44102. Indoor garden units, portable plant stands.

Sources for Plants

Alberts & Merkel, P.O. Box 537, Boynton Beach, Florida 33435. Bromeliads, gesneriads, orchids. Catalog 50 cents.



Environment/One

The Phytarium is a controlled environmental chamber for plants. Its controls can be set to turn lights on and off according to schedule, to add carbon dioxide, to water by wicking and to vent the chamber once a day.

Barrington Greenhouses, 860 Clements Bridge Road, Barrington, N.J. 08016. Miniature house plants.

Buell's Greenhouses, Eastford, Conn. 06242. Gesneriads, African-violets. Catalog \$1.

Fischer Greenhouses, Linwood, N.J. 08221. African-violets, gesneriads, supplies. Catalog 35 cents.

Fred A. Stewart, Inc., 1212 E. Las Tunas Drive, San Gabriel, Calif. 91778. Orchids.

George W. Park Seed Company, Inc. Address above. Seeds of house plants.

Hausermann's Orchids, P.O. Box 363, Elmhurst, Illinois 60126. Orchid species. Hobby Nursery, 5230 Franklin Blvd., Sacramento, Calif. 95820. African-violets. List 10 cents.

J & L Orchids, Chestnut Hill Road, R.D. 2, Pottstown, Pa. 19464. Orchids. Send stamp for list.

Kartuz Greenhouses, 92 Chestnut St., Wilmington, Mass. 01887. Begonias, gesneriads, etc. Catalog 50 cents.

Logee's Greenhouses, Danielson, Conn. 06239. Begonias, gesneriads, etc. Catalog 50 cents.

Lyndon Lyon, Mutchler St., Dolgeville, N.Y. 13329. Gesneriads. Send stamp.

Merry Gardens, Camden, Maine 04843. House plants. Catalog 50 cents.

Paul P. Lowe, 23045 S.W. 123 Road, Goulds, Florida 33170. Orchids, gesneriads. List 10 cents.

Tinari Greenhouses, address above. African-violets.

Whistling Hill, Box 27, Hamburg, N.Y. 14075. Gesneriads, unusual plants. List 10 cents.

Books

An Easy Guide to Artificial Light-gardening for Pleasure and Profit, Vernon Johnson and Winifred Carriere. Hearthside Press. 1964.

Gardening Indoors Under Lights, Frederick H. and Jacqueline Kranz. Viking Press. 1957.

Growing Plants Under Artificial Light, Peggy Schulz. M. Barrows & Co. 1955.

Fluorescent Light Gardening, Elaine C. Cherry. D. Van Nostrand Co. 1965.

The Complete Book of Gardening Under Lights, Elvin McDonald. Doubleday & Co. 1965.



Various kinds of gesneriads and other house plants thrive under concealed fluorescent lights in a home-constructed wooden cabinet. Doors can be opened or kept closed to adjust humidity.

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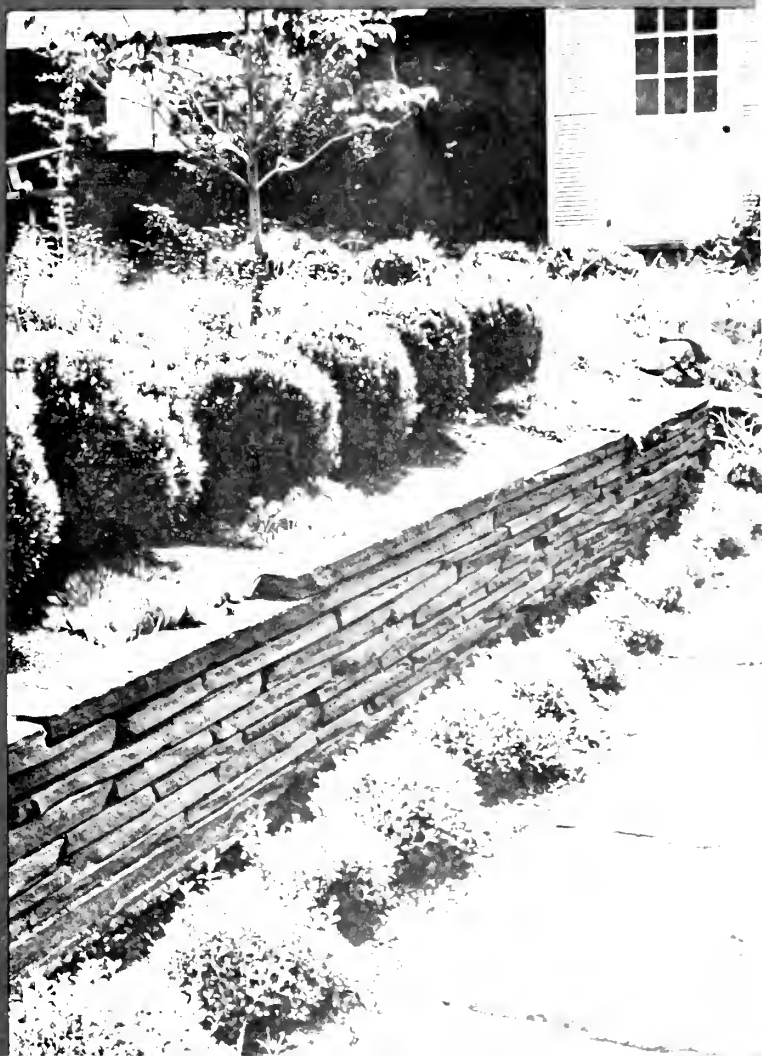
List of Retail
& Wholesale
Nursery Sources

SUMMER

1970

NEW SERIES

No. 2



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Copies of special subject issues of **PLANTS & GARDENS** are available as Handbooks.
For a list of topics see back cover.



Arthur Norman Orans

Beauty in age—the massive yet balanced trunk and branch formation of the yellow-wood (*Cladrastis lutea*) in the Brooklyn Botanic Garden. It was planted in 1916.

BROOKLYN BOTANIC GARDEN

In the spring of 1960 the Botanic Garden published a Handbook, Trees and Shrubs for Every Purpose—Where to Buy Them. Since then there have been many changes in nurseries and their plant listings, and readers' requests have virtually obliged the Garden to issue a new Handbook on the subject. 1,200 Trees and Shrubs—Where to Buy Them is a response to those requests. It is a brand new Handbook, completely re-done and enlarged. Only the basic approach of grouping trees and shrubs by major categories (i. e., Deciduous Trees Planted for Foliage, Flowering Trees, etc.) has been retained.

This nursery source guide is not casual bedside reading. Like the earlier Handbook, it is a reference work, and space limitations have permitted only brief descriptions of plants. The main purpose of the Handbook is to make easier the horticulturist's search for particular plants. In this respect, it is noteworthy that not one of the nurseries cited was asked to pay for being included in this issue.

Neophyte gardeners should not be dismayed by the extensive use of botanical names. They are the precise horticultural language and will greatly increase your chances of getting exactly the plant you desire. Wherever possible, common names have also been given, but even here it should be said that "common" names often vary according to geographical region. Note that there are separate indices for botanical and common names, beginning on page 93.

All readers are urged to turn to pages 4-6 and 82 before reading the text. Letter code sources refer to retail or mixed retail-wholesale nurseries, number codes to exclusively wholesale nurseries. The latter are not equipped to sell directly to the home gardener. Unless you are a nurseryman, please do not attempt to purchase plants from strictly wholesale firms.

Your attention is directed to Frederick McGourty, Jr., Associate Taxonomist at the Botanic Garden, and Editor of this Handbook. With this issue Fred succeeds Dr. Avery as overseer of PLANTS & GARDENS. Among other things, he is responsible for the 1,200 tree and shrub descriptions that comprise the text. As Director of Brooklyn Botanic Garden, I congratulate Fred on his initial effort as Editor.

It takes many people to put together a Botanic Garden Handbook and, while Mr. McGourty and Marjorie J. Dietz, Associate Editor of PLANTS & GARDENS, have been the persons most closely involved with this issue, the assistance of Lois Beckett Himes of the Instruction Department should be acknowledged. Credit must also be given Alfred Fordham, Jamaica Plain, Massachusetts; Conrad Gutermuth, Canton, Ohio; and Joseph Witt, Seattle, Washington, all of whom supplied helpful information.

For the future, to help PLANTS & GARDENS and to assist Fred McGourty in his new task, please direct all editorial correspondence to him. If you have suggestions about improving future editions of this Handbook, he would be pleased to hear them.

Good reading. Good gardening.



Director

BUYING TIPS FOR TREES AND SHRUBS

THE enterprising gardener usually purchases plants from a variety of sources—local nurseries, garden centers, landscape enterprises, hobby gardens and mail-order firms. Since the listings of each firm are necessarily limited, it is frequently necessary for the home gardener, and even the landscape specialist and nurseryman, to engage in time-consuming searches for choice and uncommon plants. Often, the hunt is a frustrating one, and less satisfactory plants must be substituted for ones originally desired. While the 1,200 woody plants cited in this Handbook by no means include all that exist in the American nursery trade, it is hoped that this edition of *Trees and Shrubs—Where to Buy Them* will make the search easier.

Should specimen-size trees be desired, they are usually best purchased locally, especially if they are balled and burlapped ("B & B"), for the cost and danger of shipping large plants is substantial. Some regional firms that specialize in uncommon species of landscape size are listed in the Handbook, and the horticultural enthusiast must be prepared to drive some distances to obtain such plants if the nursery does not have a truck delivery service in the particular area.

A local nursery may often try to assist you in obtaining larger sizes of uncommon trees. You can assist by providing the wholesale sources of particular plants, cited by number code in the rear of this Handbook. (The telephone can minimize the frustration of such a hunt, especially in the busy season. Telephone numbers along with addresses are given in the Source List beginning on page 82.) However, it is always wise to order far in advance, since desirable plants are often sold out early in the season.

Many fine shrubs and trees are unavailable locally, but there are mail-order firms that will supply these plants, generally in modest sizes. With the exception of evergreens and a few other plants that

nurseries usually ship in pots or with small balls of soil, woody plants are sent bare-root, with plastic wrapping and sphagnum or similar material to keep the roots from drying out. Bare-root plants may be sent only when dormant, that is, in the cooler months of the year. The common shipping seasons, depending on climate, are October to December and March to May.

Because autumn is usually the least busy shipping time in the nursery year, it may be expected that orders receive more attention at that time than in the spring months. The gardener may also be sure that plants shipped in autumn will have been freshly dug. Because of the large volume of business in the short spring season, some large nurseries dig plants in the autumn and store them in cold houses over winter. Although storage methods have improved in recent years, plants often are "worse for wear" from such treatment.

Where the climate permits, generally Zone 5 (Arnold Arboretum map) and southward, autumn delivery has other advantages as well. Many shrubs and trees planted in fall will become quickly established and make better growth in the ensuing year than those planted in spring. They may also require less watering in summer since their roots will be better established.

Regardless of the time of year a shrub or tree is planted, it is advisable to mulch it well with pine needles, ground bark, wood chips or similar material (*not* peat moss). Protect with fine mesh wire if rabbits or field mice are common. For planting instructions see any basic gardening book—or the Brooklyn Botanic Garden HANDBOOK ON GARDENING (available from the Garden for \$1).

Unless a cold frame is available, spring delivery is normally preferable for very small sizes or for plants of borderline hardiness. Spring planting is advised for



Marjorie J. Dietz

Many nurseries serve as garden centers while carrying on mail-order business.

a few trees and shrubs in bare-root condition. Most notable are cherries and other members of the genus *Prunus*, goldenrain-tree, tamarisk, broom, rose-of-Sharon, some maples and oaks. Magnolias and tulip-tree, even with a good soil ball, should not be planted in autumn. Very small evergreens are also more safely planted in spring.

Consult your local arboretum or county agent if you are in doubt about an appropriate planting time in your area for a special shrub or tree. A member of the arboretum staff or agent may give more explicit information about the hardiness of a plant in a particular area, since climate zones, while very useful, are but general guides.

Mail-order firms usually ship larger sizes by Railway Express, smaller sizes by Parcel Post or sometimes by bus. If one chooses Parcel Post, the extra charge for "special handling" is a good precaution. When shipments are made across the country, air freight is well worth the extra expense.

Most plant losses are due to transit delays, not to faulty packing. Mail-order firms are working with the postal authorities to improve service, which, as gardeners know, has left something to be desired in

recent years. It is hoped that the reorganization of the post office will eventually be beneficial to those who order by mail.

A word should also be said about commercial garden centers, which have proliferated around the country in the last ten or fifteen years. Increasingly, the plants that they sell are container-grown. A good garden center will have a substantial variety of these plants, purchased usually from large wholesale firms. To the home gardener, the chief convenience of such stock is that it extends the planting season beyond the spring limits.

If one purchases container-grown stock in summer, it is wise to wait until a cool, cloudy day before transplanting it to the garden. Be careful to inspect the soil mold upon freeing the plant from the container. If roots encircle the outer rim of soil, make several sharp—but not deep—cuts to break the outer white mesh of roots. Otherwise, there is danger of a root system that may eventually girdle and perhaps even kill the plant. It is always wise to remove some top growth to compensate for root loss.

In this Handbook, every effort has been made to evolve as simple a key as possible. The following paragraphs explain the key and various designations



Marjorie J. Dietz

An aged oak trunk serves as back-drop for shadbush's delicate flowers.

used in the plant listings:

Numbers in parentheses after a botanical name refer to hardiness zones—the northern limit of winter hardiness of a tree or shrub. (See Hardiness Map inside the back cover.) “B” after a hardiness code number indicates that the plant is hardy in the southern half of a particular zone. Hardiness varies, even within a species, and depends in part upon microclimates within each garden.

When hybrid trees or shrubs are cited, the two parents are linked with an “×” in parentheses after the botanical name. For example, the red horse-chestnut is listed botanically as *Aesculus carnea* (*hippocastanum* × *parva*).

Parentheses after a botanical name are also used to denote synonymy. *Magnolia virginiana* (*glauca*) indicates that the correct name is *M.* (abbreviation in this instance for *Magnolia*) *virginiana*, but readers may find the tree listed in some catalogs under the incorrect name *M. glauca*. When ordering, give both names.

Letter codes following a description refer to retail (or mixed retail-wholesale) sources. **Number codes** refer to exclusively wholesale sources. For more details see the code explanations beginning on page 82.

The heights attributed to trees and shrubs are considered in terms of average garden conditions. In their native state, or with great age or under special conditions, trees and shrubs may grow taller than the heights cited.

Flowering times are for the New York City area, and they merely represent an average. It is not uncommon, depending on the particular year, for a plant to flower two weeks earlier or two weeks later than usual. Summer flowering time is especially variable. If you know the flowering time of a special shrub or tree in your area, it will be easy to guess when others will be in flower by cross-checking with the “indicator” plant.

An asterisk after the nursery codes indicates that the plant is listed in far too many catalogs to cite fully. One may assume that such plants are among the most common in the trade and can usually be obtained locally with no difficulty.

DECIDUOUS TREES PLANTED FOR FOLIAGE

*Those useful as shade trees marked “†”
(See also Flowering Trees)*

Conifers That Lose Leaves In Winter

Larch

Larix decidua (europaea) (3-2B)

EUROPEAN LARCH

Pyramidal tree to about 75 ft., often with gracefully pendulous branchlets at maturity. Fine yellow autumn color. CO, DU, FO, GI, HE, LI, ML, PF, RI, RO, SI, VA, WN, 7, 22.

Larix kaempferi (leptolepis) (4-3B)

JAPANESE LARCH

Tall-growing, openly pyramidal tree with horizontal branching. Rather fast-growing. BR, ED, FO, OL, SI, WA, WN, 15, 16.

Larix occidentalis (5)

WESTERN LARCH

Narrowly pyramidal tree with short, horizontal branches. The tallest larch—occasionally to over 200 ft. in the Pacific Northwest. ML, SI, VA, 33.

Dawn-redwood

Metasequoia glyptostroboides (5-4B)

Graceful tree, strongly pyramidal. Under favorable conditions it is capable of growing 60 ft. in 20 years. Good reddish-brown autumn color. BR, EA, EM, FO, GI, HA, HE, KE, ML, OL, PR, RO, WG, 5, 20, 22, 28, 36, 44.

Golden-larch

Pseudolarix amabilis (kaempferi) (5)

Fine, tall, openly pyramidal tree with 2-in.-long needles in clusters. Golden-yellow autumn color. Good winter effect with short, stubby spur branches. BR, 22.

Bald-cypress

Taxodium distichum (4)

Densely pyramidal, sometimes nearly columnar, large tree with attractive shred-

ding bark. The woody root projections or “knees” of this native of southern swamps occur only in moist soil. Adaptable to a wide range of growing conditions. Refined small comb-like needles. BR, EA, FO, HE, LC, LI, ML, RK, SI, SR, 14, 21, 28, 34, 35, 44, 47.

Other Deciduous Trees

Maple

Acer buergerianum (6)

TRIDENT MAPLE

Refined, small, spreading tree to 25-30 ft. Short, 3-lobed leaves turn red in autumn. Leaves vary in size; forms with smaller leaves are good bonsai candidates. GO, ML, SI, 29, 39, 44.

Acer campestre (5-4B)

HEDGE MAPLE

Rather slow-growing, round-headed tree, eventually to about 25 ft. Because of its small leaves and dense habit, it is often used in Europe as a clipped hedge. ED, HE, LC, SH, SI, 5, 21, 28, 29, 36.

Acer circinatum (5)

VINE MAPLE

Shrubby small tree from the West Coast, rather like *A. palmatum*. Attractive in flower. Good autumn color. Tolerates partial shade. ED, FO, LI, RI, RO, SI, WI, 5, 42.

Acer davidii (6B)

DAVID MAPLE

Small to medium-sized tree from China. Younger wood striped white, effective in winter. Leaves mostly unlobed. GO, ML, 17, 21.

Acer ginnala (2)

AMUR MAPLE

Dense shrubby tree to 15-20 ft. Small leaves turn brilliant scarlet in autumn. A good hedge plant in cold climates. DE, EA, FO, HE, KR, KS, LI, LT, NE, PV, RI, SH, SI, WN, 5, 15, 21, 28, 35.

Acer griseum (5)

PAPER-BARK MAPLE

Superb small tree with outstanding cinnamon-colored, peeling bark. This species from western China has year-round interest. Leaves trifoliate. GO, HE, KI, LI, LN, PR, RF, RI, RO, WG, WN, 17, 22, 28.

Acer grosseri hersii (5?)

HIERS MAPLE

Small tree from central China. Conspicuous red twigs in winter. ED, GO, 17.

Acer japonicum 'Aconitifolium' (5)

HALF-MOON MAPLE

Small tree with distinctively cut leaves that have fine red autumn color. Variable but usually very handsome. BR, RF, 42.

Acer japonicum 'Aureum' (5)

GOLDEN FULL-MOON MAPLE

Small tree with yellow leaves. More attractive than most with such foliage. BR, PA, RF, SP, 38.

†**Acer macrophyllum** (6)

BIG-LEAF MAPLE

A common, sizable West-Coast tree with the largest leaves of any maple—as much as 1 ft. across. Casts dense shade and needs much room for full development. Generally unsatisfactory in the Northeast. SI.

†**Acer negundo**

BOX-ELDER

A weedy maple to 50 or 60 ft. with large compound leaves. Suited only for cold, windy areas where other trees fail. AE, DE, PV, RI, SI, VA, 15, 32, 44, 47. *Selected Form:* 'Variegatum.' Handsome tree with variegated-silver leaves. RF, 42.

†**Acer nikoense** (6-5B)

NIKKO MAPLE

Rather slow-growing, vase-shaped tree, eventually to 40 ft. or more. The trifoliate leaves have good red-to-purple autumn color. GI, GO, RI, 17.

Acer palmatum (4) (some forms less hardy)

JAPANESE MAPLE

A variable but always attractive slow-growing, small tree or shrub. Refined small leaves with usually good red autumn color about two weeks later than native maples. Japanese maple and its many forms are prime bonsai candidates. BH, ED, FO, HE, ML, PT, RI, RO, SI, 4, 21, 22, 30, 38, 40, 42, 44. *Selected Forms:* 'Atropurpureum.' PURPLE-LEAF JAPANESE MAPLE. CB, ED, EM, GI, HY, RI, RO, SH, SI, SR, VI, WG, WN, 3, 21, 28, 35, 41, 42.

'Burgundy Lace.' Cut-leaf form with reddish-purple leaves. PR, RF, 38, 44.

'Dissectum.' THREAD-LEAF JAPANESE MAPLE. Slow-growing, dense mound, usually broader than tall. Leaves deeply cut, almost shredded. BR, ED, PA, PT, RO, SP, VI, WF, 8, 15, 17, 22, 28, 44.

'Koshimino.' BR, RF, 15.

'Okushimo.' BR, RF, SP.

'Ornatum' ('Dissectum Atropurpureum'). RED THREAD-LEAF JAPANESE MAPLE. BR, CB, ED, FO, OL, PA, RO, SP, VI, WG, 8, 15, 17, 21, 38, 41, 44.

'Oshio-Beni.' CM, PR, RF, WN, 15, 38, 42, 44.

'Sangokaku.' Brilliant red winter twigs, BR, CM, 15, 36, 42.

'Shishigashira' (6-5B?). Exceptionally slow-growing form with very small leaves. Perhaps the best form for bonsai. BR, KI, PA, RF, SP.

'Versicolor.' Green leaves variegated pink and white. BR, RF, SP, 36.

Acer pensylvanicum (3)

STRIPED MAPLE, MOOSEWOOD

Small but vigorous shade-tolerant tree, primarily associated with cooler parts of the North. Branchlets green with white stripes. Large, slightly coarse leaves. BR, DU, GA, SN.

†**Acer platanoides** (3)

NORWAY MAPLE

Broadly rounded tree to 90 ft. with large lobed leaves casting dense shade. Little autumn color. Tolerates diverse conditions but does not thrive as a street tree in New York. Many forms are more tender than the species. GE, HY, KE, KR, ML, MU, NE, RO, SH, SR, ST, ZI, 7, 9, 15, 19, 21, 28.* *Selected Forms:*

'Columnare.' A 40-ft. tree may have a 24-ft. spread. Ascending branches. BU, ED, FE, FO, LC, LI, LT, MK, SH, SQ, WB, WN, ZI, 2, 5, 21, 28, 31, 32, 38.

'Crimson King.' (5). Leaves deep purple through summer. BU, ED, FA, FE, GU, KE, KR, MB, ML, SH, ST, SR, WN, ZI, 3, 5, 19, 21, 28, 31, 38.*

'Drummondii' ('Harlequin'). Leaves edged white. Handsome. DA, ED, FO, GE, GU, LC, LN, MB, MK, ML, SH, 21, 29, 31, 42.

'Emerald Queen.' Fast-growing, with broadly ascending branches and shiny dark green leaves. BA, FE, LC, LI, LN, MK, PV, RS, SH, WN, 3, 5, 6, 9, 28, 32, 42.

'Globosum.' Small globe-shaped tree more suitable than the species for planting under utility wires. CO, FO, 5, 29.

'Greenlace.' Attractive cut-leaf form. 5, 32, 42.

'Schwedleri.' Leaves open purple in spring,

turn deep green by early summer. Attractive because of seasonal changes. BA, CO, FE, GU, HY, KS, LA, LN, LT, MK, ML, PV, RO, SR, WN, 3, 5, 19, 28, 32.

'Summershade.' Said to have deep green leathery foliage resistant to heat and windburn. BA, CO, LI, LT, PV, SH, 5, 6, 20, 28, 42.

†**Acer pseudoplatanus** (5)

SYCAMORE MAPLE

Coarse, large-leaved, broad-headed tree to 60 ft. or more. Tolerates coastal conditions. Poor autumn color. A prolific seeder. FO, LT, WN, 28. *Selected Form:* **'Spaethii.'** Leaves purplish-red beneath. MD, 29, 42.

†**Acer rubrum**

RED, SCARLET OR SWAMP MAPLE

Eventually tall-growing tree, often with rounded habit. Conspicuous in flower in early spring. Early autumn coloration—usually a good red. DU, EA, ED, HA, HY, LA, LI, MB, ML, NE, SH, SR, WN, 5, 7, 9, 15, 21, 28. *Selected Forms:*

'Armstrong.' Very narrow growth habit. LI, SH, 5.

'Columnare.' DA, FO, LC, SH, 5, 28.

'October Glory.' With crimson autumn foliage several weeks after others have shed their leaves. LI, MD, WN, 5, 22, 28, 42.

Acer rufinerve (5)

RED-VEIN MAPLE

Spreading tree to about 30 ft. Attractive 3-lobed, dark green leaves turn crimson in autumn. GO, 17, 36, 44.

†**Acer saccharinum** (*dasycarpum*) (3)

SILVER MAPLE

Tall, fast-growing tree with brittle branches. Handsome, deeply lobed green leaves, whitish beneath. Of little value where better trees can be grown. Primarily for cold, windy areas. Re-seeds prolifically. BU, CO, EM, FE, GE, KE, KR, KS, LT, MB, ML, NE, ZI, 5, 16, 21, 28, 41.* *Selected Forms:*

'Laciniatum' (**'Wieri'**). Cut-leaved, with graceful pendulous branches. FO, RI, SH, 21, 42.

'Silver Queen.' Seedless. EM, IN, KR, MB, SR, ZI.

†**Acer saccharum** (3)

SUGAR MAPLE

Tall-growing tree with generally oval habit and rough gray bark. Autumn color variable but often brilliant orange-red. It provides the backbone of the New England autumn. There are better maples for urban conditions. BU, ED, FA, FE, HA, HY, KE, LI, ML, NE, RO, SH, WN, 3,

5, 6, 7, 19, 28.* *Selected Forms:*

'Green Mountain.' Said to be more tolerant of windy sites because of its thick, waxy, dark green leaves. BA, LI, WN, 6, 22, 28.

'Newton Sentry.' (**'Columnare'**) (4). Superb very narrow form. A 25-ft. tree at Brooklyn Botanic Garden is unbranched. DA, 29.

'Temple's Upright' (**'Monumentale'**) (4). Excellent narrow-growing form without a central leader. BR, DA, FO, RF, WN, 28, 42.

Acer spicatum

MOUNTAIN MAPLE

Shrubby small tree with often fine orange autumn color. Creamy flower spikes, which appear in early June in New England, are among the most conspicuous of any maple's. DU, GA, SN.

Acer tataricum (4)

TATARIAN MAPLE

Small tree with bright green leaves and yellow-to-red autumn coloring. DA, VA, 5.

Tree-of-heaven, Ailanthus

†**Ailanthus altissima** (4)

A common weed tree of American cities, suited for only the most difficult sites. FO, ML, RO, SH.

Alder

Alnus cordata (5)

ITALIAN ALDER

Small to medium-sized tree with shiny heart-shaped leaves. Attractive catkins in late winter. Suited for moist sites, but where there is good drainage, better trees may be selected. BH, FO, RO, 26, 43, 46.

Alnus glutinosa (3)

EUROPEAN ALDER

Round-headed tree of medium-size. Leaves retained far into autumn. For moist sites. Several graceful cut-leaf alder forms exist, but they have been slow to come into the trade. BH, FO, HE, 44.

†**Alnus rhombifolia** (5)

CALIFORNIA WHITE ALDER

Rounded tree to 60 ft. or more, with dense foliage. Suited for moist locations on the West Coast. BH, PT, 26, 43, 44, 46.

Pawpaw

Asimina triloba (5)

Small tree or occasionally a multi-stemmed shrub with drooping leaves 6-12 in. long. Of interest mainly for its 2-3-in.-long edible fruits, which led an enterprising nurseryman to call it "Michigan banana

tree." It is a member of the largely tropical custard-apple family. BR, DA, EM, ME, RK, TE, ZI, 47.

Birch

Betula albo-sinensis septentrionalis (5)

CHINESE PAPER BIRCH

Large rounded tree with splendid orange-brown peeling bark. SH, 17.

†*Betula lenta* (3)

SWEET BIRCH

Pyramidal tree to about 50 ft. Brownish-red-to-black cherry-like bark. Good yellow autumn color. GA, ML, SN.

Betula lutea (3)

YELLOW BIRCH

Tree to 60-70 ft. with broad open head and silvery yellow bark. Native to much of the Northeast and best grown in cool areas. FO, GA, SN.

†*Betula maximowicziana* (5-4B)

MONARCH BIRCH

Tall tree with spreading crown and stoutly ascending branches. The peeling white bark, which has an orange hue, is attractive in all seasons. The common name of this Japanese tree is appropriate. 5, 44.

Betula nigra (4)

RIVER BIRCH

Graceful, more-or-less pyramidal tree to about 50 ft. Peeling bark, dull reddish-white to black. Grows well on moist sites. BA, BH, FO, HE, LC, LI, LN, ML, MK, NE, RK, 22, 32, 47.

†*Betula papyrifera* (2)

CANOE OR PAPER BIRCH

Splendid, eventually tall-growing tree with pure white peeling bark. Usually pyramidal. Not for urban areas. AE, KR, LC, LT, MK, ML, MU, RK, RO, RS, SH, WN, 3, 5, 6, 10, 28, 36, 42.

Betula pendula (alba) (verrucosa) (3)

EUROPEAN WHITE BIRCH

Graceful medium-sized tree with white bark and somewhat pendulous branches. Often sold in clump form. Like most other birches, it is pest-prone. Systemic insecticides may be used to control birch-leaf miner. BU, CO, GE, KS, MB, ML, NE, PV, RO, SA, VI, WN, 3, 5, 9, 20, 28, 31, 47.* *Selected Forms:*
'Fastigiata.' Strongly columnar. BR, DA, SH, VI, WN, 4, 17, 28, 42.

'Gracilis.' (*'Laciniata'*). CUT-LEAF EUROPEAN BIRCH. Delicate small tree with slender weeping branches and finely dissected leaves. BU, CO, EM, FE, GU, KE, KR, KS, LT, ML, RO, WG, WN, 7, 10,

19, 28, 31, 41, 42.*

'Purple Splendor.' Purple-leaved. BR, EM, FO, RO, 42.

'Youngii.' YOUNG'S WEEPING BIRCH. Asymmetrical weeping form. Should be staked while young. BR, CO, DA, LI, LT, MD, OL, RO, SH, SQ, VI, WN, 8, 17, 21, 38, 42.

Betula populifolia (4)

GRAY BIRCH

Usually a multi-stemmed small tree, common to abandoned fields in New England. The dull gray-white bark is attractive, but few old specimens are seen. Tolerant of poor, moist soil. Often infested with birch-leaf miner. DA, DU, GA, GI, LA, LN, RO, SN, 9, 20, 21, 28.

Hornbeam

†*Carpinus betulus* (5-4B)

EUROPEAN HORNBEAM

Medium-sized to large spreading tree with strong, sometimes ascending branches. Attractive beech-like bark, but darker gray and sinewy. LI, 21, 28, 29, 36. *Selected Form:* *'Fastigiata.'* Columnar in youth; older trees become vase-shaped. BR, DA, FO, GI, LI, RO, SA, SH, WN, 5, 10, 28, 34, 36.

Carpinus caroliniana (3-2B)

AMERICAN HORNBEAM, IRONWOOD

Small tree, occasionally shrubby, with smooth, sinewy, bright gray bark. Good orange or red autumn color. BR, DU, FO, LI, LN, SI, SN, 7, 15, 28, 36, 47.

Pecan, Hickory

†*Carya illinoensis* (pecan) (5)

PECAN

The tallest hickory, with massive branching habit and compound leaves that may be 18 or 20 in. long. While hardy northward, it is a dependable nut producer only in the South. Numerous forms exist, selected for their nuts and relative hardiness. BO, DA, EM, HA, KR, LN, MB, ML, SR, ST, TE, ZI, 15, 47.

†*Carya ovata* (4-3B)

SHAGBARK HICKORY

Very slow-growing, upright, often narrow tree to 75 ft. Noted for its loose plates of gray bark and edible nuts. Difficult to transplant. BO, ML, SR, ST, TE, 47.

Hackberry

†*Celtis laevigata* (5)

SUGAR HACKBERRY

This southern species is ultimately a larger

tree (80-90 ft.) than common hackberry. It is resistant to witches'-broom infestations, which may or may not be a desirable trait. DU.

Celtis occidentalis (4-3B)

COMMON HACKBERRY

Round-headed tree, often small because of witches'-brooms, short twiggy growths that contribute some winter character to the outline of the tree. Blistered gray bark. BA, DU, FO, LC, LI, LN, MB, SH, 4, 28, 31, 32.

Katsura-tree

Cercidiphyllum japonicum (4)

Frequently a spreading, multi-stemmed tree growing to 45 ft. or more. Massive at maturity. Trained to a single trunk, it may form a narrow tree for some time. Fine-textured, small bluish-green leaves and yellow-to-scarlet autumn color. A variable species, some trees much more attractive than others. EA, FO, HE, LA, LI, LT, ML, PF, RO, SQ, WG, WN, 5, 6, 17, 28, 44.

Turkish Hazelnut

†Corylus colurna (4)

Sturdy, broadly pyramidal tree to 45 ft. or more. Fairly clean foliage that in time casts a deep shade. Catkins provide interest in late winter. Nuts, when produced, are often unnoticed, except by squirrels. DU, HE, SH.

Persimmon

Diospyros kaki (7)

KAKI OR JAPANESE PERSIMMON

Small to medium-sized tree with rounded head and lustrous dark green leaves that often have good autumn color. The ornamental orange-yellow fruit is edible, many commercial varieties having been selected over the years. While dioecious, some forms produce fruit without pollination. BO, CA, EM, GE, HA, ML, TE, 22.

Diospyros virginiana (5)

COMMON PERSIMMON

A horizontally branched tree that may, under excellent conditions, grow to 70 ft. or more in the South, usually much less in the North. Sometimes more-or-less shrubby. Narrow growth habit while young. Glossy dark green leaves and small, edible fruit. Mainly of use in wild-life plantings. BR, DU, HE, LI, ML, RK, ZI, 47.

Russian-olive

Elaeagnus angustifolia (3)

Small spreading tree or large shrub with fine gray foliage much like that of the true olive. A useful tree for contrast, and especially attractive when planted near purple-leaved trees. Drought-resistant. Tolerant of a wide range of soil conditions. BA, BU, DE, EM, FA, FE, IN, KE, KS, RK, SH, ST, ZI, 5, 6, 15, 28.*

For other *Elaeagnus*, see page 56.

Beech

†Fagus grandifolia (americana) (3)

AMERICAN BEECH

A beautiful, tall-growing tree with smooth, silvery gray bark and shiny, leathery, coarsely serrate leaves that turn pigskin-brown after many other trees have shed their foliage in autumn. Unlike European beech it will often have root sprouts. DA, DU, EA, FO, HE, LI, ML, RO, SN, VI, WB, 15, 20, 22, 28, 47.

†Fagus sylvatica (5-4B)

EUROPEAN BEECH

Tolerant of a wider range of growing conditions than American beech, the European species has slightly deeper gray bark and smaller leaves. It is extraordinarily variable. European beech and many of its forms are among the most handsome large trees hardy in the North. EA, ED, FO, GI, HE, HY, LI, LT, RO, SH, VI, 15, 21, 28, 39, 40, 42. *Selected Forms:*

'*Asplenifolia*.' FERN-LEAF BEECH. One of the most attractive—and robust—trees with deeply cut foliage. It is very dense for many years and some of the secondary branches might best be pruned to provide an opening so the gray trunk may be seen. BR, DA, FO, LI, RO, WF, WG, WN, 15, 21, 28, 38, 40.

'*Cuprea*.' COPPER BEECH. Young foliage has a fine, light reddish-bronze hue. Once a popular tree, but now largely superseded by Rivers purple beech. SH.

'*Fastigiata*.' COLUMNAR BEECH. Narrow-growing form to 25 ft. or more. BR, DA, ED, FO, RO, SH, WA, WF, WG, WN, 15, 17, 21, 22, 28, 38.

'*Pendula*.' WEEPING BEECH. Old specimens that have been given ample room to develop are magnificent trees. The form encountered most frequently in America is usually as broad as tall and may attain a height of 45 ft. or more. In Europe a tall, narrow-growing, pendulous form is more often seen. While an occasional old specimen

may be seen on estates here, this latter form does not appear to be distinguished in the American trade. It is well suited for today's gardens. DA, FO, GI, HE, LI, MD, ML, RO, WF, WG, WN, 8, 15, 21, 22, 28, 29, 38, 40, 42.

'Purpureo-Pendula.' PURPLE WEEPING BEECH. Small tree to 10 or 15 ft., height dependent on where grafted. It forms a neat dome much like Teas weeping mulberry. BR, DA, FO, ML, OL, RF, RO, SP, WF, WG, WN, 8, 15, 21, 38, 42.

'Riversii.' RIVERS PURPLE BEECH. Young foliage greenish-red but becoming purplish-black as the season progresses. DA, ED, EM, FO, LI, LT, MD, ML, SH, WF, ZI, 9, 15, 21, 38, 28, 40, 42.*

'Rohanii.' CUT-LEAF PURPLE BEECH. Sizeable with age. BR, CB, DA, FO, GI, HE, LI, WF, WN, 15, 38.

'Rotundifolia.' Small coin-like leaves. Less vigorous than others, but trees of 50 ft. or more are known. BR, ML, RF, 15, 38.

'Spaethiana.' Reported to hold deep purple leaf color through the summer. Eventually a large tree. FO, GI, LI, WF, WN.

'Tricolor.' TRICOLOR BEECH. Novelty form with pink, white and green leaf color. Less vigorous than other forms. More-or-less bushy in youth. DA, FO, LI, MD, ML, RF, RO, WF, WG, WN, 15, 21, 29, 38, 42.

Common Fig

Ficus carica (6)

Small shrubby tree with wide coarse leaves of tropical appearance. Evergreen southwards. Needs protected site in North. BO, CA, EM, GE, HA, SR, 12, 20.

Ash

†*Fraxinus americana* (3)

WHITE ASH

Fast-growing, rather weedy, tall tree, often with an oval crown that is handsome at maturity. Although the wood is used for baseball bats, the brittle twigs may produce constant litter on lawns. Primarily for cold climates where better trees cannot be grown, or for situations where an immediate effect is needed. CO, FO, GE, HE, LI, MU, NE, SH, SR, ST, 21, 28, 31.* *Selected Form: 'Rosehill.'* Seedless. PV, RO, 28, 42.

†*Fraxinus excelsior* (5-4B)

EUROPEAN ASH

Tall round-headed tree without the good yellow-purple autumn color of white ash, but somewhat more refined. ED, MK, SH. *Selected Form: 'Pendula.'* WEEPING EURO-

PEAN ASH. Picturesque, strongly weeping small tree. Effective in winter. CO, FO, 29.

Fraxinus holotricha 'Moraine' (5)

MORaine ASH

Much smaller tree—to about 35 ft.—than American ash. Vigorous. Few seeds produced. CO, DA, ED, FO, LC, LT, RO.

Fraxinus pennsylvanica lanceolata (3)

GREEN ASH

Tree to about 45 ft. with rounded crown. Like white ash, fast-growing and tolerant of a wide range of conditions. Best for the Plains States. AE, DE, FA, FE, FO, GE, HE, LN, MA, RS, 5, 21, 28, 31, 34. *Selected Form: 'Marshall's Seedless.'* BA, EM, FE, GU, HE, IN, KE, KS, LI, MK, NE, RS, WG, 5, 16, 19, 28, 31, 42, 44.

Fraxinus quadrangulata (3)

BLUE ASH

Medium-to-tall tree with narrow crown, corky 4-winged twigs and deep green leaves. FO, LC, LT, 4, 21.

Fraxinus velutina 'Glabra' (5)

MODESTO ASH

Strong-growing but fairly small tree. Tolerant of dry, alkaline soils. BH, CA, ED, FO, PT, 4, 5, 28, 30, 42.

For other ash, see page 22.

Ginkgo, Maidenhair-tree

†*Ginkgo biloba* (4)

Eventually tall-growing tree with small leaves shaped like duck feet. Asymmetrical, sometimes gawky branching. Usually good yellow autumn color. Tolerant of a wide range of growing conditions. Gardeners should seek out staminate (male) forms, for the fruit on pistillate trees has a foul odor when crushed. DA, ED, EM, FE, GI, HA, KE, LT, ML, MU, RI, SH, SI, WG, WN, 4, 5, 10, 14, 15, 28, 32, 46. *Selected Forms: 'Autumn Gold.'* Good autumn color. Staminate. BH, CA, DA, GI, HE, LI, PR, PT, RO, WN, 1, 5, 30, 44.

'Fastigiata.' Narrow tall-growing form with strongly ascending branches. Usually staminate. DA, GI, ML, 15, 38, 44.

'Pendula.' Small spreading tree with pendulous branches. Mainly for the collector. BR, GI, RF, SP, 15, 38.

Thornless Honey Locust

Gleditsia triacanthos inermis (4)

Rapid-growing, medium-sized tree with upright or spreading form. Rather small, refined compound leaves provide a light, airy effect. Tolerant of a wide range of growing conditions. While not pest-free,

it is often planted in cities as a replacement for the American elm, although there is no resemblance. Numerous seedless or nearly seedless forms, differing slightly, exist in the trade. Best purchased in its forms. *Selected Forms:*

'Imperial.' With straight trunk. BA, CO, FO, LA, LC, LI, LN, LT, MK, RO, WN, 5, 6, 19.

'Moraine.' Wide-spreading. CA, DA, FO, LA, LC, LI, LT, MB, ML, PF, RO, WG, 21, 30.

'Rubylace.' New growth red. Best seen before purchased. FA, FO, KE, KS, LA, MB, ML, SH, WG, ZI, 28, 31, 32, 42.

'Shademaster.' Upright. BA, BU, ED, EM, FE, HY, KE, LI, MB, PF, RO, SH, WN, 3, 9, 20, 21, 28, 32.*

'Skyline.' Pyramidal. BA, CO, DA, FO, GU, LC, MA, RO, WN, 3, 5, 16, 31, 32, 42.

'Sunburst.' New foliage golden yellow. Best seen before purchased. ED, FA, FE, GI, KE, LT, MA, ML, RO, SH, SR, WG, 5, 20, 21, 28, 30, 32, 46.*

Kentucky Coffee-tree

†Gymnocladus dioicus (4-3B)

Tree to 50 ft. or more, noted for its stark winter outline. The large, doubly compound leaves appear late in spring and drop early in autumn. BA, DU, EA, FO, HE, LC, LI, ML, RO, WB, 20, 22, 28, 29, 31, 47.

Butternut, Walnut

†Juglans cinerea (3)

BUTTERNUT

Short-trunked, spreading, medium-sized tree with compound leaves. Grown occasionally for its nuts. EM, FO, KE, KR, ML, SR, ST, TE, ZI, 47.

†Juglans nigra (4-3B)

BLACK WALNUT

Tree to 60 ft. or more, similar to *J. cinerea* except for its nuts. While old trees are often picturesque, they are not good lawn trees because of their messy fruit. FA, FE, FO, GI, GU, KE, LC, ML, ST, TE, 21, 32. *Selected Form:* 'Thomas.' Better nuts. BO, EM, FE, KR, MB, ML, NE, SR, ZI.

†Juglans regia (6-5B)

ENGLISH or PERSIAN WALNUT

Broad-headed tree to 60 ft. or more. Grayish trunk and coarse compound leaves. Many forms exist. BO, CA, ED, MA, 21. *Selected Form:* Carpathian Strain (5). Hardier than the species. BO, DA, EM,

FE, FO, HA, KE, LC, ST, ZI, 47.

Sweet Gum

†Liquidambar formosana (7)

FORMOSA SWEET GUM

Tall-growing pyramidal tree with larger leaves than those of American sweet gum. They are tinted purple upon opening. Good autumn color. BH, 30.

†Liquidambar styraciflua (4)

AMERICAN SWEET GUM

Broadly pyramidal tree to 60 ft. or more with attractive lobed leaves that often turn a fine red in autumn. Gum "balls" used in winter decorations. DA, DU, EA, ED, EM, HY, KR, ML, NE, RO, SR, ZI, 2, 9, 30, 35, 40, 41, 42. *Selected Form:* 'Palo Alto.' LI, PT, 30, 43, 44, 46.

Osage-orange

Maclura pomifera (6)

OSAGE-ORANGE

Usually a small, irregularly spreading tree with orange-brown bark. Old specimens may sometimes attain 60 ft. or more. Once a popular hedge plant because of its glossy foliage, thorny twigs and suckering habit. Curious baseball-sized, yellow-green fruit on pistillate trees. DU, PV.

Mulberry

Morus alba (4)

WHITE MULBERRY

Round-topped small tree with bright green leaves. Of use only on difficult sites or for wild-life plantings. Pistillate trees, bearing messy purple-to-white fruits, should not be planted near paths. Except for alanthus, white mulberry is the most common weed tree in New York City. 21, 26. *Selected Forms:*

Fruitless clones. Useful mainly in air-polluted areas. BH, CA, FO, PT, 29, 30, 44, 46.

'Pendula.' TEAS WEEPING MULBERRY. Strongly pendulous, dense, small tree, height dependent on where grafted. Despite messy fruit, this once popular tree still has "architectural" merit. At least one fruitless clone exists, but it is not listed as such in the trade. FO, HE, LT, RO, SH, WN, 4, 21, 30, 44, 46.

Var. tatarica. RUSSIAN MULBERRY. Small fruits. Apparently hardier than the species. Useful wild-life tree. BA, DU, FO, GU, KS, LT, MB, ML, SI, WN, ZI, 32, 42, 47.

Sour Gum, Pepperidge-tree, Tupelo

†*Nyssa sylvatica* (4)

Fairly narrow tree to 50 ft. or more with horizontal, often slightly pendulous branches. Lustrous green leaves turn brilliant purple or scarlet in early autumn. Advisable to plant only young or frequently root-pruned specimens. BH, DA, DU, FO, HE, LI, ML, MU, RO, WN, 5, 15, 28, 35, 44, 47.

Hop-hornbeam

†*Ostrya virginiana* (4-3B)

Relatively slow-growing, broadly pyramidal tree to about 45 ft. Light yellow fruits are cone-like from a distance. Fairly pest-free. DU, FO, HE, LI, LN, RS, SH, SN, 5, 20, 28, 47.

Parrotia

Parrotia persica (5)

Shrub-like spreading tree that may after many years attain 40 ft. or more. Massive at maturity. Conspicuous mottled bark much like *stewartia*. Small red witch-hazel-like flowers in very early spring, often not borne in colder areas. Excellent scarlet-to-yellow autumn color. BR, DA, GO, RO, 15, 36.

Amur Cork-tree

†*Phellodendron amurense* (4-3B)

Spreading, stoutly branched tree to 35 or 40 ft. Gray, cork-like bark and rather coarse compound leaves. Fast-growing. Old trees are imposing in winter. BA, DA, DU, EM, FO, GU, HE, ML, RO, SH, SI, WN, 3, 5, 15, 28, 36, 47.

Chinese Pistache

Pistacia chinensis (6?)

Broadly rounded, medium-sized tree with short trunk. Refined, fairly small compound leaves turning vivid orange-red in autumn. Grown at least as far north as Philadelphia (Morris Arboretum). BH, PT, RI, 26, 30, 43, 44.

Plane-tree, Sycamore

†*Platanus acerifolia* (*occidentalis* × *orientalis*) (5)

LONDON PLANE-TREE

Tall, ultimately wide-spreading tree with attractive flaky outer bark. While anthracnose has diminished its utility in some areas, it is still one of the most valuable large street trees. Tolerant of an amazingly wide range of growing con-

ditions. Incorrectly called *P. orientalis* in some catalogs. True *P. orientalis* is seldom encountered in American gardens. CO, ED, FO, KS, LC, LI, PF, PT, RO, SH, ST, VI, WN, 5, 9, 20, 21, 28, 32, 43.* *Selected Form: Bloodgood Strain.* Reportedly resistant to anthracnose. 5.

†*Platanus occidentalis* (5-4B)

SYCAMORE, BUTTON-WOOD

Probably the most massive—although not the tallest—deciduous tree of North America. While the upper parts of the sycamore often have more silvery bark than the London plane, it is not as adaptable in cultivation, nor is it as pest-resistant. Anthracnose is a major problem. BH, FE, FO, GE, LC, LT, MB, MU, RO, 15, 28, 30, 31, 47.

†*Platanus racemosa* (7)

CALIFORNIA PLANE-TREE

Tall, stoutly branched tree with picturesque growth habit and flaky bark. Often multi-stemmed. Pest-prone. BH, CA, PT, 30, 43, 44.

Poplar

Populus alba (3)

WHITE POPLAR

Tall, irregularly open tree with maple-like leaves, whitish beneath. All poplars are fast-growing and weak-wooded. While often attractive, they are useful mainly in the northern Plains States where growing conditions are difficult, or on poorly drained land. Recently, interest in them has risen because of their resistance to air pollution, but unless planted in parks, they are not good city trees. They should never be planted near sewer or water lines. 21. *Selected Forms:*

'Nivea.' SILVER POPLAR. Leaves silvery white beneath, attractive in a breeze. CA, FO, RI, SI, 32, 47.

'Pyramidalis' ('Bolleana'). BOLLEANA POP-LAR. Handsome narrow columnar tree to 50 ft. or more. Perhaps the best columnar poplar. BA, CO, ED, FE, GU, KS, LN, MB, ML, RO, SH, 5, 21, 28, 31, 42.

Populus canadensis 'Eugenei' (*deltoides* × *nigra*) (4)

CAROLINA POPLAR

Tall wide-spreading tree of rapid growth. A poor lawn tree because of constant twig fall. CA, CO, SH, WE, 28, 42.

†*Populus maximowiczii* (4)

JAPANESE POPLAR

Tall tree with wide-spreading branches and dark green leaves, whitish beneath. LI, 7, 20, 21, 28.

Populus nigra 'Italica' (4-3B)

LOMBARDY POPLAR

Graceful tall sentinel, useful for a quick screen, but short-lived. Canker-prone. BU, EM, FA, GI, GU, KE, LT, MB, ML, RS, SR, ZI, 3, 7, 20, 28, 31.*

Populus nigra 'Theves' (4-3B)

THEVES POPLAR

With the general habit of Lombardy poplar, but reported to be somewhat more pest-resistant. CO, DE, FE, LI, ML, SH, VA, 5, 32.

Populus simonii (4-3B)

SIMON OF CHINESE POPLAR

Handsome pyramidal tree to 35 or 40 ft. Small bright green leaves. One of the most attractive species. LI, VA, WB, 7. *Selected Form: 'Fastigiata.'* Narrowly columnar, although neither as columnar nor as tall as Lombardy poplar. CO, GI, SH, 5, 28.

Populus tremuloides (1)

QUAKING ASPEN

Often a rather small tree with oval or rounded form. Occasionally to 90 ft. in favorable parts of its immense natural range (Newfoundland to Alaska and northern Mexico). Handsome in a grove or near water. Bark smooth grayish-white. The attractive small leaves flutter in the slightest breeze. HE, KS, LC, RI.

Plum, Choke-cherry

Prunus blireiana (cerasifera 'Atropurpurea' × mume) (5)

BLIREIANA PLUM

Rounded tree to about 20 ft. with reddish-purple leaves. Double light pink flowers in early mid-spring. BH, CA, DA, ED, FO, HY, LI, MA, PT, 4, 28, 29, 42. *Selected Form: 'Newport.'* Leaves dark purple. BA, BT, GE, HA, HE, KE, KR, KS, ML, 3, 5, 9, 21, 31, 42.

Prunus cerasifera 'Atropurpurea' (pissardii) (4)

PISSARD PLUM

Densely branched, upright tree to about 20 ft. Leaves reddish-purple. Single pink flowers a little before mid-spring. Small edible fruit. Many selections, differing slightly in leaf color and flowers, have been made over the years. BH, CA, FO, MB, PT, VI, 30, 42. *Selected Forms:*

'Nigra.' BLACK MYROBALAN PLUM. Leaves dark purple. CO, ED, LA.

'Thundercloud.' Retains good deep purple foliage through summer. CA, CB, CO, GD, LI, LT, MA, ML, RO, SR, WB, 2, 4,

5, 21, 28, 38.

'Vesuvius.' Relatively large, very deep purple leaves. Seldom flowers. BH, 4, 29, 42, 43, 46.

Prunus virginiana 'Shubert' (2)

SHUBERT CHOKE-CHERRY

Small tree with leaves first appearing green, then turning purple in late spring. Racemes of small white flowers in midspring. BA, DE, FA, FO, HE, KS, LN, RS, VA.

For other *Prunus*, see pp. 26, 45, 60.

Hop-tree, Wafer-ash

Ptelea trifoliata (4)

Rounded small tree or shrub with handsome foliage somewhat resembling poison-ivy. Seeds eaten by birds. DU, FO, HE, ML, 47.

Oak

†Quercus acutissima (6-5B)

SAW-TOOTH OAK

Spreading tree with rounded crown to 45 ft. or more. Excellent foliage somewhat like that of American chestnut. Choice. HE, 5, 21, 28, 47.

†Quercus alba (4)

WHITE OAK

Slow-growing, eventually tall tree with stout spreading branches. Stately in old age. Leaves with rounded sinuses and lobes. Reddish-purple autumn color. Not thriving in New York City. DU, FO, GA, HE, LC, LI, ML, MU, PV, SN, VA, 15, 20, 21, 28.

†Quercus bicolor (3)

SWAMP WHITE OAK

Similar to the preceding species but with slightly less refined leaves. It is a species recommended for moist soils. FO, HE, LC, LI, LN.

†Quercus borealis (rubra) (4-3B)

RED OAK

Pyramidal, eventually tall tree. Relatively fast grower. Dark red autumn color. This and most of the other common oaks tolerate city conditions well. CO, DA, EA, ED, FE, GU, LI, MK, ML, PV, RO, SR, WN, 5, 7, 15, 28, 32.

†Quercus coccinea (5-4B)

SCARLET OAK

Fine round-headed tree with shiny green leaves. Superb autumn color. Rather difficult to transplant. CA, DA, FO, HE, LI, LN, MA, RO, SI, WB, WE, WN, 10, 21, 28, 42.

†*Quercus imbricaria* (5)

SHINGLE OAK

Broadly pyramidal tree to about 50 ft. Narrow, unlobed dark green leaves. Deep red-to-yellow autumn color. BR, DU, HE, LC, LI, LN, MU, 5, 15, 28, 34.

†*Quercus laurifolia* (7)

LAUREL OAK

This oak is a round-topped southern tree to 60 ft. Lustrous semi-evergreen leaves. WB, 12.

†*Quercus macrocarpa* (3)

BURR or MOSSY CUP OAK

Broadly rounded tree to 80 ft. or more; stout branching habit and often corky-winged twigs. Shiny dark green leaves similar to those of white oak. DU, FO, HE, LC, PV, VA, 15, 21, 28, 36, 44, 47.

†*Quercus nigra* (6)

WATER OAK

Tree to 60 ft. with conical or rounded head and slender branches. Small bluish-green leaves. GE, 12, 20, 47.

†*Quercus palustris* (4)

PIN OAK

Handsome pyramidal, eventually tall-growing tree with drooping lower branches. Deeply cut green leaves often turn a fine red in autumn, but it should be said that autumn color is variable with most such trees. BA, CO, ED, EM, FE, FO, GI, ILY, IN, KE, MB, NE, SH, VI, WN, ZI, 5, 10, 15, 28, 32, 38, 42. *Selected Form*: 'Sovereign.' All branches ascending. It is not columnar. 5.

†*Quercus phellos* (5)

WILLOW OAK

Southern tree to 50-60 ft. with deep green, willow-like leaves. Autumn color yellow. DA, DU, GE, ML, SI, WB, 5, 20, 21, 28, 42, 44, 47.

†*Quercus prinus* (montana) (4)

CHESTNUT OAK

Tree to 50 or 60 ft. with deeply grooved bark somewhat like that of black locust. Suitable for dry, rocky soil. Shiny chestnut-like leaves become orange in autumn. DU, FO, LC, ML, 20, 47.

†*Quercus robur* (4)

ENGLISH OAK

Tall tree with massive spreading branches. Picturesque at maturity. Refined small leaves. Poor autumn color. BR, ED, FO, LI, LN, MU, SH, 28, 39. *Selected form*: *Var. fastigiata*. COLUMNAR ENGLISH OAK. To 40-50 ft. One of the best columnar trees. DA, ED, FO, IN, LC, LI, ML, SH, WN, 15, 17, 28, 36, 42.

†*Quercus shumardii* (5)

SHUMARD OAK

Similar to scarlet oak but with deeply cut leaves. LC, LI, 5, 15, 42, 47.

†*Quercus velutina* (5)

BLACK OAK

One of the tallest northern oaks. Large shiny leaves orange-red in autumn. ML.

Willow

Salix alba (2)

WHITE WILLOW

Tall tree with upright branches. Golden yellow twig color is conspicuous in winter. Willows, while often very graceful, are short-lived, and their constant twig fall diminishes their usefulness as lawn specimens. The tree forms are fast-growing and in nature are usually associated with moist soils, although in the garden they may grow well with average soil drainage. None should be planted near sewer or water lines. MK. *Selected Forms*:

'Chermesina' ('Britzensis'). Twigs reddish. In Europe it is usually grown as a shrub, pruned severely in early spring to encourage vigorous growth that is attractive the following winter. FO.

Var. sericea. Foliage gray-green or gray. VA.

'Tristis' ('Niobe,' 'Vitellina Pendula'). GOLDEN NIOBE WEeping WILLOW. Stems brilliantly golden yellow in winter. BA, EM, FE, GU, KS, LI, MK, RO, RS, SH, ST, WB, 3, 7, 16, 28, 31, 47.

Salix babylonica (6)

BABYLON WEeping WILLOW

The most intensely pendulous willow, but it lacks the good winter twig color of the preceding species. A classic tree, but often mixed up in the trade, as are other willows. BH, DA, EA, GE, HA, PT, 14, 20, 30, 41, 43. *Selected Form*: 'Crispa.' RING-LEAF WILLOW. Leaves folded and spirally curved, somewhat resembling a ram's horn. BR, IN, ML, WA.

Salix blanda (babylonica × fragilis) (4)

WISCONSIN WEeping WILLOW

Tree with graceful pendulous branches, but only half as long as those of *S. elegantissima*. Reddish-brown twig color. BT, BU, EM, FE, KE, LI, MU, SI, ZI, 21, 31, 32.

Salix elegantissima (?babylonica × fragilis) (4-3B)

THURLOW WEeping WILLOW

Perhaps the most gracefully pendulous

willow for the northern states. WB, 28.

Salix matsudana 'Tortuosa' (5-4B)

CORKSCREW WILLOW

Upright tree to 30 ft. or more. Branches twisted. Effective in winter, but best to see before purchasing. Twigs useful for winter decorations. BA, CB, DA, ED, FO, GI, MK, ML, RS, SH, SI, 10, 19, 20, 28, 47.

Salix pentandra (4)

LAUREL WILLOW

Rounded upright tree to about 40 ft. Shiny dark green leaves. AE, BA, CO, DE, ED, FA, GU, MK, RO, SH, VA, 7, 28, 32.

Salix sepulcralis (salamonii) (babylonica × alba) (5-4B)

SALAMON WEEPING WILLOW

Ultimately a sizable tree with spreading branches and loosely pendulous branchlets. GI, WG, 10.

For other *Salix*, see pp. 50, 61.

Sassafras

Sassafras albidum (5-4B)

Rather narrow, upright tree with green twigs and lustrous leaves that occasionally have deep sinuses. Orange-scarlet fall color. DU, FO, HE, LC, LI, ML, 22, 47.

Linden, Basswood

†Tilia americana (2)

BASSWOOD, AMERICAN LINDEN

Tall tree with oval or spreading crown. The large coarse leaves are insect-prone, but, as with other lindens, the fragrant small flowers are attractive to bees. Tolerant of a wide range of growing conditions, but specimens in New York City have shown air pollution injury in recent years. BA, FA, FO, HE, KR, KS, LC, LN, MK, RS, WB, 5, 21, 28, 32. *Selected Form:* 'Fastigiata.' GI, LI, 5.

†Tilia cordata (3)

LITTLE-LEAF LINDEN

Pyramidal, eventually tall tree with relatively small, heart-shaped leaves. Tolerant of diverse growing conditions and often used as a street tree. Like most lindens, an excellent shade tree. Variable. CO, DA, FA, FE, GD, GI, MA, ML, PF, RS, SR, 5, 7, 19, 21, 32, 41. *Selected Form:* 'Greenspire.' With straight single trunk, radially produced branches and spire-like crown. BA, CO, DA, FE, FO, KE, KS, RO, RS, SH, WG, 6, 7, 20, 22, 28, 31.

†Tilia euchlora (?cordata × dasystyla) (4)

CRIMEAN LINDEN

Large spreading tree with glossy bright

green leaves. FO, GI, LC, LI, SH, 5, 21, 28. *Selected Form:* 'Redmond.' Densely pyramidal. BA, FA, GU, HE, LI, LN, MB, MK, PV, 28, 31, 32.

†Tilia europaea (vulgaris) (cordata × platyphyllos) (4-3B)

COMMON EUROPEAN LINDEN

Large spreading tree with dark green leaves. Associated with old estates. FO, 15, 21.

Tilia mongolica (4)

MONGOLIAN LINDEN

Refined pyramidal tree to about 30 ft. Small deeply cut leaves very distinct from those of other lindens. LI, VA, 29.

†Tilia petiolaris (5)

WEEPING SILVER LINDEN

Beautiful large estate tree with leaves silvery-white beneath, fluttering in the slightest breeze. BR, ED, LC, LI.

†Tilia platyphyllos (3)

BIG-LEAF LINDEN

Large, rounded or pyramidal tree with rather coarse 5-in.-wide leaves. Dense shade. *Selected Form:* 'Fastigiata.' Narrow columnar habit. LT.

†Tilia tomentosa (5-4B)

SILVER LINDEN

Stoutly branched, broadly pyramidal, tall tree with leaves conspicuously white beneath. One of the most handsome lindens, but mainly a park or estate tree. BR, FO, HE, LI, 5, 9, 19, 20, 28.

Elm

†Ulmus americana (2)

AMERICAN ELM

Beautiful tall vase-shaped tree known to everyone who has grown up in a small town in the eastern half of the continent. Not now recommended for general planting where Dutch elm disease is prevalent. AE, DA, DE, ED, FO, GU, PV, RS.

Ulmus carpinifolia (4)

SMOOTH-LEAVED ELM

Tall tree with rounded to pyramidal habit. LT. *Selected Form:* 'Christine Buisman.' Oval-shaped tree more-or-less resistant to Dutch elm disease. It does not have the vase-shaped habit of the American elm. FO, GD, LN, PF, 5, 6, 32, 36.

Ulmus glabra 'Camperdownii' (4)

CAMPERDOWN ELM

Picturesque small tree often twice as broad as tall, with asymmetrically weeping branches. A popular old estate tree with excellent winter character, but not

immune to Dutch elm disease. FO, LT, OL, RO, 8, 21, 29, 42.

***Ulmus parvifolia* (5)**

CHINESE ELM

Round-topped tree of medium size with 1-2-in.-long leaves that sometimes have good red autumn color, a unique character among elms. Some trees have fine mottled bark. Resistant to Dutch elm disease. One of the best elms for general planting. Not to be confused with *U. pumila*, which is often listed in catalogs as "Chinese elm." FO, LI, LN, 5. *Selected Form: 'Pendens' ('Sempervirens')*. EVERGREEN ELM. Evergreen only in mild climates. Drooping branches. BH, ML, PT, 30, 43, 44, 46.

***Ulmus pumila* (3)**

SIBERIAN ELM

Fast-growing, weak-wooded tree to about 50 ft. Small fine-textured leaves. Used sometimes as a hedge in cold areas. Drought resistant. Often planted in the Midwest. Resistant to Dutch elm disease. AE, BU, CA, CO, DE, EM, GE, KS, MK, ML, 30,

31, 32, 42, 46.

Zelkova

†*Zelkova serrata* (5)

JAPANESE ZELKOVA, GRAY-BARK or KEAKI ELM

Tall, broadly round-headed tree with ascending branches. This elm relative is mechanically resistant to Dutch elm disease because of its smooth gray bark, which is plated orange-yellow on older specimens. Bonsai. BH, DA, GI, HY, LC, LI, LT, PF, PT, RI, RO, SI, 5, 17, 20, 26, 36, 46. *Selected Form: 'Village Green.'* Straight-trunked form said to resemble the American elm. 5, 20, 22, 28.

Jujube, Chinese-date

***Zizyphus jujuba* (6)**

Small tree or shrub with shiny leaves, inconspicuous yellow flowers and edible reddish-black fruit. May not fruit dependably in the northern part of its hardiness range. SR, TE.



George Talbouis

Flowering dogwood (*Cornus florida*) is an attractive small tree as an accent or as part of a group, as in this planting which includes rhododendrons and junipers.

FLOWERING TREES

Those useful as shade trees marked "†"
(See also *Deciduous Trees Planted for Foliage*)

Horse-Chestnut, Buckeye

†*Aesculus carnea* (hippocastanum × pavia)
(4)

RED HORSE-CHESTNUT

Round-headed tree to 60 ft. or more. Flowers in upright clusters, flesh-colored to deep red. Early May. FO, HE, LI, RO, WN, 29, 44. *Selected Form: 'Briotii.'* Flowers bright scarlet. DA, ED, LI, LT, RO, WG, 4, 21, 22, 28, 29.

Aesculus glabra (3)

OHIO BUCKEYE

Round-headed tree to about 30 ft. with greenish-yellow flowers in 6-in. upright panicles in early May. Rather coarse foliage turns orange in autumn. BA, FO, LN, ML, SH, VA, WB, WG.

†*Aesculus hippocastanum* (3)

COMMON HORSE-CHESTNUT

Oval-shaped, eventually spreading tree to 60 ft. or more. Showy upright clusters of white flowers, tinged red, in early May. The leaves, susceptible to an unsightly leaf scorch in dry summers, cast a dense shade. Fruits nostalgia but messy. Mainly an estate or park tree. BA, ED, FO, GI, LI, SI, 7, 28, 42. *Selected Form: 'Baumannii' (4-3B).* DOUBLE-FLOWERED HORSE-CHESTNUT. Similar to the preceding, but with double flowers. *Does not set fruit.* FO, LI, RO, WN, 4, 21, 28, 29.

†*Aesculus octandra* (5)

SWEET BUCKEYE

Large spreading tree with conspicuous upright panicles of yellow flowers in mid-spring. Leaves turn yellow in autumn. FO, GA, LC, RK, 47.

Aesculus parviflora (see p. 41.)

Silk-tree

Albizia julibrissin (7)

SILK-TREE

Tree to 25 ft. or more with open, spreading habit. Flowers light pink, resembling powder-puffs. July-August. Refined, doubly compound leaves. Very late to leaf out in spring. Often called "mimosa." Some trees offered are likely the hardier variety *rosea*. Both are valued for their relatively

long flowering season, but individual trees vary in flower color and length of bloom. CB, GE, PT, RK, RO, SI, TE, VI, WB, 11, 20, 42, 43, 47.

Albizia julibrissin rosea (6-5)

HARDY SILK-TREE

Similar to the preceding, but with deeper pink flowers. Hardier. Often shrubby in cold areas. BU, DA, PF, WA, WN, 21, 47.

Shadbush, Service-berry

Amelanchier canadensis (4)

Tree to 40 ft. or more with rather narrow habit. Often more-or-less shrubby. White flowers in mid-April in New York area are pretty but short-lived. Birds quickly eat the purple berries that ripen in June. Smooth gray bark attractive in winter. HE, LC, LI, LT, MU, PF, RO, SN, SQ, WB, WN, 5, 7, 16, 21, 28, 32, 35, 47.

Amelanchier grandiflora (canadensis × laevis) (4)

APPLE SERVICE-BERRY

Similar to the preceding, but with slightly larger flowers, pink in bud. Branches spreading. HE, LC, LI, LN, ML, PR, WN, 5, 36. *Named Form: 'Rubescens.'* Flowers open pink, changing quickly to white. WG.

Amelanchier laevis (3)

ALLEGHANY SERVICE-BERRY

Handsome tree to about 30 ft. Spreading branches and smooth gray bark. Young leaves reddish-bronze. Flowers and fruits similar to *A. canadensis*. Of year-round interest. FO, GA, LI, WN, 36.

Chestnut

†*Castanea mollissima* (5-4B)

CHINESE CHESTNUT

Tree to about 60 ft. with dense, rounded head. Lustrous foliage. The long catkins of creamy-white flowers, while ill-scented, are handsome in late June or July. Resistant to chestnut bark disease. If grown for nuts, two or more trees should be planted. BO, BT, DA, EA, FE, FO, GI, HE, KE, KR, LA, MU, SQ, WN, 10, 14, 22, 28, 36, 47.

Catalpa

†Catalpa speciosa (4-3B)

Tall rapid-growing tree of loosely pyramidal habit. Coarse. Conspicuous panicles of white flowers, marked yellow, in June. Large heart-shaped leaves. Bean-like pods persist into winter. Mainly a park or estate tree. CO, ED, GE, MA, PV, SI, TE, 11, 32, 42, 46, 47.

Redbud

Cercis canadensis (4)

EASTERN REDBUD

Tree to 25 ft. or more, with loose open habit and rather small heart-shaped leaves. Rosy purple pea-like flowers in early May. FO, HA, KR, KS, LT, MU, NE, RO, SI, ST, WG, WN, ZI, 1, 5, 11, 12, 15, 28, 31, 42, 44. * *Selected Forms*:

Var. alba. White flowers. CB, FO, HA, HE, LC, LI, RO, WN, 12.

'Wither's Pink Charm.' Flowers soft pink. CB, FO.

Other forms, including *'Forest Pansy'* (leaves purple), available from Warren & Son Nursery, 10901 N. E. 23rd., Oklahoma City, Oklahoma 73161.

Cercis chinensis (5)

CHINESE REDBUD

Small tree, usually shrubby, to 10 ft. or more. Rosy purple flowers in early May. More conspicuous in bloom than *C. canadensis*. DA, EA, HA, ML, NE, RO, SI, WG, WN, 1, 15, 20, 28, 41, 47.

Fringe-tree

Chionanthus virginicus (4)

Tree to about 20 ft., often shrubby and broader than tall at maturity. Drooping loose panicles of white flowers in early June. DA, EA, GA, HE, LA, LC, LI, PR, RO, SQ, VI, WG, WN, 5, 9, 20, 21, 22, 28, 47.

Yellow-wood

†Cladrastis lutea (3)

Rounded tree to 40 ft. or more with smooth gray bark. Fragrant white wisteria-like flowers in late May. Ages gracefully. FO, HE, LC, LI, LN, LT, ML, PF, RO, WB, WN.

Clethra

Clethra barbinervis (5-4B)

Small tree, often multi-stemmed, with horizontal racemes of fragrant white

flowers in July. Outstanding cinnamon bark. Choice. 22.

Dogwood

Cornus alternifolia (3)

PAGODA DOGWOOD

Small tree, often shrubby, with markedly horizontal branching. Clusters of modestly attractive, small white flowers in May followed by blue-black berries in summer. Tolerant of shade. Because birds favor the fruit, most dogwoods are good for wild-life plantings. Nearly all are satisfactory in a naturalistic setting. BA, DE, DU, FO, LN, MK, SH, SN, 21, 32.

Cornus florida (5-4B)

FLOWERING DOGWOOD

Small tree with horizontal branching. Flower bracts white, showy. Early May. Berries and autumn foliage color red. Common but choice, although not always easy to grow well because of borers and other pests. Acid soil. ED, FO, GE, KE, LC, LT, NE, SI, ST, VI, WG, ZI, 5, 6, 7, 9, 12, 28, 42, 47. * *Selected Forms*:

'Cherokee Chief.' Flower bracts ruby red. BO, BT, BU, CB, EM, GE, HA, IN, KR, LI, LN, ML, NE, RO, TE, ZI, 6, 11, 25, 42.

'Cherokee Princess.' Numerous, large white flower bracts. BO, LI, LN, MA, RO, 5, 25, 42.

'Cloud 9.' White bracts. Blooms while young. EM, HA, LI, LT, ML, NE, RO, WN, 8, 10, 25.

'Pendula.' Stiffly weeping branches. Bracts white. KI, ML, OL, RF, RO, VI, WN, 15, 22, 38, 42.

'Pluribracteata' (*'Plena'*). Double white flower bracts. CB, DA, HA, WN, 21, 36, 38.

'Welchii.' Grown only for its foliage, colored green, white and pink. CB, DA, OL, RO, VI, WN, 21, 22, 38, 42.

'White Cloud.' Numerous white bracts produced while young. WG.

Cornus florida rubra (5)

PINK FLOWERING DOGWOOD

Flower bracts vary from pink to deep red. CB, ED, EM, ML, MU, NE, RO, ST, VI, WB, WN, 5, 6, 15, 28, 35, 36, 38, 47. *

Cornus kousa (5)

JAPANESE OR KOUSSA DOGWOOD

Tree to 15 ft. or more, with spreading dense habit at maturity. White flower bracts are similar to *C. florida*, but pointed. Bracts effective for several weeks in June. Fruits strawberry-like, edible. Autumn

foliage red. The mottled brown and white bark is attractive in winter. A superb tree, which often performs better in New York City than *C. florida*. ED, FO, HY, LI, LT, OL, RI, RO, SA, SI, VI, WA, WN, 3, 5, 15, 17, 20, 21, 28, 40. *Selected Forms:*

'Milky Way' Flowers profuse. WG.

Var. *sinensis*. Bracts slightly longer than in the species. CB, LI, ML, RF, RO, WG, WN, 4, 9, 15, 17, 21, 22, 34, 36, 38, 41.

Cornus mas (4-3B)

CORNELIAN-CHERRY

Small spreading tree or large shrub with clusters of tiny yellow flowers in early spring. Conspicuous red, cherry-like fruit in late summer. DA, HE, LA, LC, LI, LT, PF, RO, SH, WN, 4, 5, 6, 28.

Cornus nuttallii (7-6B)

PACIFIC DOGWOOD

A giant by dogwood standards—to 60 ft. or more. Growth habit fairly narrow compared with *C. florida*. Large white flower bracts, 4-6 in a group. April-flowering, but often with occasional flowers in late summer. A handsome tree, but generally not performing well in the East. ED, RA, RI, SI, 39, 42. *Selected Hybrid: 'Eddie's White Wonder' (nuttallii × florida)*. Slightly hardier than *C. nuttallii*, but flower buds will blast in a severe New York winter. ED, WG.

Hawthorn

Crataegus arnoldiana (4-3B)

Dense rounded tree to about 20 ft. Thorny, like most in the genus. Moderately showy white flowers in late April. Orange-red fruit conspicuous in late summer before other hawthorn fruit ripens. This and other hawthorns are generally recommended by authorities as being excellent choices for wild-life plantings. FO.

Crataegus coccinoides (5-4B)

KANSAS HAWTHORN

Densely branched, round-headed tree to 15-20 ft. White flowers in early May. Fruit dark crimson. Good autumn foliage color. DU, MK.

Crataegus crus-galli (4)

COCKSPUR HAWTHORN

Fiercely armed tree to 25 ft. or more. Dense, often as broad as tall. Shiny leaves. White flowers in mid-May. Bright red fruit persists into winter. Excellent wild-life cover. BA, DU, FO, HE, LC, LI, LN, MK, RO, SQ, WB, WN, 3, 15, 16, 21, 28

Crataegus lavalley (carrieri) (crus-galli × pubescens) (4)

LAVALLE HAWTHORN

Densely branched tree to 15 or 20 ft. Numerous white flower clusters in mid-May. Scarlet fruit persists into winter. Good autumn foliage color. CA, FO, LI, RO, WN, 4, 5, 6, 21, 28, 29, 32, 34, 42.

Crataegus monogyna 'Stricta' (4-3B)

Fastigate tree to 20 ft. or more. Narrow habit less notable at maturity. White flowers in mid-May. Red fruits. No autumn leaf color. ED, MD, WG, 4, 5, 17, 21, 29, 36.

Crataegus nitida (4-3B)

GLOSSY HAWTHORN

Round-headed tree to about 25 ft. Shiny leaves with orange-red autumn color. Persistent red fruits. FO.

Crataegus oxyacantha (4)

ENGLISH HAWTHORN

Dense round-headed tree to 15 or 20 ft. with small, 3-5 lobed leaves. White flowers in mid-May. Scarlet fruit. No autumn color. This and its forms are probably the most free-flowering of all hawthorns. BII, FO, KR, RO, SI, 21, 36, 39, 42. *Selected Forms:*

'Autumn Glory.' Single white flowers. Long-lasting, large red berries in autumn. Not as hardy as the species. DA, HE, PT, RO, WG, WN, 4, 21, 42.

'Paulii.' PAUL'S SCARLET HAWTHORN. Flowers double, scarlet. Few fruits. CA, ED, FO, KE, KS, LI, LT, ML, PF, WB, WG, ZI, 3, 4, 9, 10, 28, 29, 31, 42.*

'Plena.' Double-white flowers. Few fruits. CA, ED, FO, WN, 21, 29, 42.

'Rosea Plena.' Double-pink flowers. Few fruits. CA, ED, FO, WN.

'Superba.' Flowers, single bright red with star-shaped white center. Fruits red. 28.

Crataegus phaenopyrum (cordata) (4)

Eventually round-headed tree to 20 ft. or more. Very thorny. White flowers in late May or early June. Scarlet-orange autumn foliage color. Small red fruit persists into winter. This hawthorn is suitable for conservation plantings. BA, ED, FO, GE, HE, LI, LT, PF, RI, RO, SI, WB, 5, 6, 28, 29, 32, 36, 38, 42.*

Crataegus pinnatifida major (5)

LARGE CHINESE HAWTHORN

Round-headed tree to about 15 ft. Lustrous dark green, deeply lobed leaves. The deep red fruits are exceptionally large for a hawthorn. 29.

Crataegus 'Toba' (succulenta × oxyacantha 'Paulii') (3)

Tree to about 15 ft. with fragrant, double whitish flowers. Fading pink to deep rose. DA, ED, FO, GU, LI, SH, SP, 21, 28, 29.

Crataegus viridis 'Winter King' (4)

Spreading tree, probably growing to about 25 ft. White flowers in mid-May. Profuse and persistent red fruits, borne at an early age. FO, LI, SA, 21, 22, 36.

Dove-tree

†Davidia involucrata (6-5B)

Broadly pyramidal tree to 40 ft. or more. A dogwood relative, it has two large white flower bracts of uneven size. Early or mid-May. Bracts, while striking at close range, are not long-lasting, nor are they borne at an early age. BR, DA, GO, PF, VI, WG, 20, 28.

Evodia

†Evodia hupehensis (5)

Upright-spreading tree to 30 ft. or more. Handsome flat clusters of small white flowers in July. Bees seek out the nectar. Bark smooth, gray. ML, 5, 29, 36.

Franklinia

Franklinia (Gordonia) alatamaha (5-4B)

Upright tree to about 20 ft., often shrubby in cold areas. White, 3-in.-wide, camellia-like flowers from September to frost. Autumn foliage orange-red. Good bark character. Frequently short-lived in the North, but worth growing for its year-round interest. CB, DA, EA, GO, OL, PF, RF, RO, SI, VI, WA, WB, WG, 21, 28, 36, 38, 42, 44.

Ash

Fraxinus bungeana (3)

Broad-headed tree to 10 or 12 ft. Moderately conspicuous panicles of creamy-white flowers in May. 29.

†Fraxinus ornus (5)

FLOWERING ASH

Round-headed tree to 40 ft. or more. Handsome 3-5-in.-long panicles of fragrant white flowers in early May. Distinctive. ED, RI, 5, 29, 36, 42.

For other ash species, see page 12.

Silver-bell

Halesia carolina (tetraptera) (4)

CAROLINA SILVER-BELL

Vigorous tree to about 30 ft. with spreading

branches. While not showy from a distance, the white bell-like flowers have a certain charm that is lacking in many of the common flowering trees. Early May. Few pests. FO, LC, RO, WB, 5, 20, 21, 28, 31, 36.

†Halesia monticola (5)

MOUNTAIN SILVER-BELL

Similar to the preceding, but to 60 ft. or more. Flowers slightly larger. DA, LN, ML, PF, RK, RO, SQ, WG, 5, 17, 28, 36.

Castor-aralia

Kalopanax pictum (4)

Eventually a tall tree with stout spreading branches. Large ivy-like leaves. Tropical appearance. Large showy umbels of white flowers in mid-summer. Unique and stark in winter outline. BR, LC, 5.

Golden-rain Tree

Koelreuteria paniculata (5)

Upright tree to about 30 ft. with sinuous branching that has considerable winter interest. Refined compound leaves. Conspicuous upright clusters of yellow flowers, July or later, followed by persistent lantern-like pods. Unusually tolerant of urban conditions. Best planted in spring. GI, HA, LI, ML, NE, PF, PT, RO, ST, WB, WG, WN, 5, 11, 15, 28, 29, 31, 38, 44.

Golden-chain Tree

Laburnum alpinum (4)

SCOTCH LABURNUM

Upright tree to 20 ft. or more. Flowers yellow, wisteria-like. Mid-May. 42.

Laburnum watereri (vossii) (anagyroides × alpinum) (5)

Upright tree to 20 ft. or more. Flowers similar to the preceding, not in longer pendulous clusters. Mid-May. Handsome in bloom but of little interest the rest of the year. An application of lime on highly acid soils may be beneficial, but the tree does not seem notably long-lived in the eastern U.S. CB, CO, KR, LI, LT, ML, PT, RO, SI, VI, WB, WG, ZI, 3, 4, 6, 19, 21, 28, 29, 31, 42.*

Tulip-tree

†Liriodendron tulipifera (4)

One of the tallest-growing trees of the eastern American woodland, occasionally to 150 ft. In forests its trunk is straight as a telephone pole, while in gardens where the tree has ample room to develop,

it has a fairly broad crown and is stoutly branched. Often called tulip-poplar, but its greenish-yellow flowers, inconspicuous from a distance, are closely related to magnolia. The cup-shaped flowers, with an orange band at the base, are exquisite. CA, DA, DU, EA, ED, EM, KR, ML, NE, SH, WG, WN, 5, 15, 28, 31, 43, 44, 47.

Maackia

Maackia amurensis (4)

Upright tree to 30 ft. or more, with smooth, yellow-brown bark. Small, white pea-like flowers in panicles 4-8 in. long. July or August. BR, WN, 21, 29.

Magnolia

†*Magnolia acuminata* (4)

CUCUMBER MAGNOLIA

Tall-growing tree, ultimately developing a massive trunk and branching system. While the yellowish-green flowers in late May are not conspicuous, the red seeds that follow are attractive. DU, ML, 17, 47.

Magnolia campbellii (8?)

Eventually a very tall, open-growing, sparsely branched tree. The fragrant pink cup-shaped flowers are among the most beautiful in the genus. Early spring. GO.

Magnolia cordata (5)

YELLOW CUCUMBER MAGNOLIA

Upright tree to 25 ft. or more. Yellow cup-shaped flowers in mid-May, more conspicuous than *M. acuminata*. Bright red seeds protrude from cucumber-like pods in autumn. CB, FO, GO, 22, 38.

Magnolia denudata (conspicua) (5)

YULAN MAGNOLIA

Tree to 35-40 ft. with spreading branches and smooth gray bark. The fragrant white flowers, up to 6-in. across, are outstanding in mid- or late April. One of the most attractive of the hardy magnolias. DA, DO, FO, GO, 9, 22.

Magnolia fraseri (5)

Tree to about 40 ft. with spreading branches. Fragrant creamy-white flowers in mid-May. GA.

Magnolia kobus borealis (4)

KOBUS MAGNOLIA

Upright tree to 40-45 ft. Creamy-white flowers 4-5 in. across. April. Age and patience bring flowers. DA, GO, LA, 22, 29. *Selected Form or Hybrid*: 'Wada's Memory' (5?). Conspicuous large white flowers in mid-April. Blooms while young. GO, 17.

Magnolia loebneri 'Merrill' (stellata × kobus) (4)

DR. MERRILL MAGNOLIA

Vigorous, upright-pyramidal tree with small leaves. White flowers similar to those of star magnolia (see p. 45), but slightly larger. Ultimately to 40-50 ft. BA, CB, DO, GO, IN, LC, LI, LN, LT, OL, SA, WG, WN, 5, 11, 21, 22, 35, 36, 42, 44, 47.

Magnolia macrophylla (5)

BIG-LEAF MAGNOLIA

Medium-sized southern tree with coarse leaves sometimes 30-in. long. The 1-ft.-wide, fragrant, creamy-white flowers are outstanding when not marred by rain. Very distinct, and difficult to use in the landscape scheme for that reason. BR, DA, DO, GA, GO, SI, 47.

Magnolia obovata (5)

WHITE-LEAF JAPANESE MAGNOLIA

Pyramidal open-growing tree to 70 ft. or more. Leaves 8-16 in. long, glaucous beneath. Fragrant white flowers 6-in. across. Late May. GO, 22.

Magnolia salicifolia (5)

ANISE MAGNOLIA

Pyramidal tree to 25-30 ft. Narrow leaves. Fragrant white flowers 5-in. wide. Mid-April. Blooms while young. GO, HE, LN, 29.

Magnolia sieboldii (parviflora) (6-5B)

OYAMA MAGNOLIA

Rounded tree to 20-25 ft. with leaves bluish beneath. Fragrant white flowers with scarlet stamens. Late May. ED, GO, 9.

Magnolia soulangiana (denudata × liliflora) (4-3B)

SAUCER MAGNOLIA

Spreading tree to about 20 ft., often multi-stemmed. Smooth grayish-white bark. Large, cup-shaped, white-to-purple flowers. The most common magnolia of northern gardens, and one of the prettiest in flower. Like most magnolias, it is tolerant of urban conditions. All are most safely planted in spring. CB, CO, ED, EM, HA, LI, LT, MA, NE, RO, VI, WG, 5, 6, 17, 28, 31, 35, 38, 42.* *Selected Forms*: 'Alexandrina.' Large rose-purple flowers, white inside. DO, ED, GI, GO, RK, RO, WN, 5, 28, 42, 44, 47.

'Lennei.' Dark purplish-rose flowers with occasional repeat blooms in summer. CB, DO, GO, RO, WN, 21, 22, 42.

'Liliputian.' Rose-white flowers. Slow-growing and of smaller eventual height. DO, GO.

'Rustica Rubra.' Flowers rose-red. DO, GI, GO, NE, PT.

Magnolia tripetala (4)

UMBRELLA MAGNOLIA

Small, open-headed, southern tree with 12-15-in.-long leaves and large white flowers. Fragrant. Late May. LC, ML, 1, 21.

Magnolia virginiana (glauca) (5)

SWEET BAY MAGNOLIA

Tree to 40 ft. or more in the South, shrub-like in the North. Fragrant white flowers over a long period in early summer. Attractive red seeds. Satisfactory in wet or well-drained soil. CB, DO, EA, FO, GI, GO, LA, LI, RO, SQ, WG, WN, 5, 15, 17, 20, 21, 28, 35, 38, 45.

Magnolia wilsonii (6)

Small open tree, often shrubby, Fragrant white flowers with conspicuous crimson stamens. May. GO, 17.

Other magnolias, see pages 44, 45.

Crab-apple

Malus arnoldiana (floribunda × baccata) (4-3B)

ARNOLD CRAB-APPLE

Broad dense tree to 18-20 ft. Flowers pink, fading white. Late April. Small yellow-to-red fruits. CA, GD, KR, LA, LI, LT, RO, SA, SH, VI, WN, 1, 4, 5, 19, 28, 34, 38, 42.

Malus atrosanguinea (halliana × sieboldii) (4)

CARMINE CRAB-APPLE

Rather shrubby in youth, eventually a broad-spreading tree to 15 ft. or more. Excellent character at maturity. Lustrous green foliage. Flowers crimson in bud, opening to pink. Early May. Small dark red fruits. Annual bearer. DA, GE, LI, LN, LT, MA, MK, RO, SA, SH, SQ, WN, 3, 5, 6, 19, 21, 28, 34, 38, 42.

†**Malus baccata (2)**

SIBERIAN CRAB-APPLE

Upright tree to 40-45 ft. with fragrant white flowers in late April. Small yellow or red fruits, usually borne annually. Variable. DU, FO, LT, PF, 20, 21, 28.

Selected Forms:

'Columnaris.' FO, WN.

Var. *mandshurica*. Larger flowers a week earlier. The first crab-apple to bloom in spring. LI, 31.

Malus coronaria 'Charlottae' (4)

CHARLOTTE CRAB-APPLE

Rounded tree to 15-20 ft. Attractive, large, semi-double, light pink flowers in mid- or late May after most other crab-apples have finished blooming. The large

green fruit, while not abundant, may be a nuisance on lawns. Large-fruited crab-apples should not be used as street trees. Charlotte crab-apple, as a derivative of a native crab-apple, should not be grown near red-cedar (*Juniperus virginiana*) because of cedar-apple rust. Oriental species are resistant. CB, CO, DU, ED, LI, RO, WN.

Malus floribunda (4-3B)

JAPANESE FLOWERING CRAB-APPLE

Wide-spreading tree to about 30 ft. Considerable character with age. Flower buds red, opening pink, turning white. Late April. Profuse small red or yellow fruit borne annually. Most of the single-flowering crab-apples, especially ones that have an abundance of fruit annually, are good wild-life trees. BT, CB, DU, LI, LT, MK, ML, PF, RO, SH, VI, WB, 3, 6, 28, 31, 34, 36, 38, 42.*

Malus halliana 'Parkmanii' (5)

PARKMAN CRAB-APPLE

Upright tree or tall shrub to 12-15 ft. Attractive rose-pink, semi-double flowers in late April. Fruits inconspicuous. FO, LI, RO, SQ, WN, 31.

Malus hupehensis (4)

TEA CRAB-APPLE

Vase-shaped tree to 20-25 ft. Secondary branches are often just long shoots, verging between the interestingly asymmetrical and gawky. Flower buds deep pink, flowers fading to white and fragrant. Late April. Fruits small, greenish-yellow or red. FO, HY, LA, LI, LN, LT, RO, WN, 7, 19, 21, 22, 28, 34, 36, 38, 41.

Malus ionensis 'Plena' (3-2B)

BECHTEL CRAB-APPLE

Round-headed tree to 20 ft. or more. Fragrant pink double flowers in mid-May. Few fruits. Avoid growing near red-cedar because of cedar-apple rust. BA, CA, LI, MA, MD, MK, ML, PF, PT, RO, SH, SQ, WN, 3, 9, 15, 21, 31, 36, 38.

Malus micromalus (4)

KAIDO CRAB-APPLE

Upright tree to 15-20 ft. Handsome bright pink flowers in late April. Fragrant. Small red fruits. FO, SA.

Malus purpurea 'Eleyi' (pumila niedz-wetskyana × atrosanguinea) (4-3B)

ELEY CRAB-APPLE

Dense tree to 20 ft. or more. Leaves purplish. Profuse, deep pink single flowers in late April. Fruits sparse. Susceptible to apple scab. GE, KR, LI, LT, MK, ML, PW, RO, SH, TE, VI, WB, 5, 6, 21, 28,

31, 36, 38, 42.*

Malus purpurea 'Lemoinei' (4-3B)

LEMOINE CRAB-APPLE

Similar to the preceding, but with more deeply colored flowers. Purplish-red fruits borne annually. Resistant to apple scab. FO, LI, SH, VI, WN, 5, 21, 22, 34, 41.

Malus sargentii

SARGENT CRAB-APPLE (see page 45).

Malus toringoides (5-4B)

CUT-LEAF CRAB-APPLE

Densely branched upright tree to about 20 ft. White-to-pink flowers in mid-May. Pear-shaped fruit, red on the upper side, yellow beneath. Alternate bearer. 36.

Malus zumi 'Calocarpa' (baccata mandshurica × sieboldii) (5)

ZUMI CRAB-APPLE

Densely branched pyramidal tree to 20-25 ft. Flower buds pink, opening white in late April. Fragrant. Profuse small red fruits held into winter. Alternate bearer. BA, CB, DA, DU, EA, LI, LT, MK, PF, RO, SA, SQ, 5, 6, 15, 16, 28, 31, 34, 36.

Other Crab-apples of Hybrid Origin:

Malus 'Almey' (4)

Vigorous tree to 15-20 ft. Flowers rosy-red with white center. This and the following crab-apples usually flower in early May. Bronze foliage. This crab-apple has red fruit in autumn. BT, CB, ED, EM, GU, KE, LI, LT, PF, RO, SH, WB, 3, 5, 28, 29, 36, 38, 40, 42.*

Malus 'Baskatong' (4)

Tree to 25 ft. or more. Reddish-bronze foliage. Flower buds carmine, flowers fading to dull pink. Single. Red fruit. SH.

Malus 'Crimson Brilliant' (4)

Rounded tree to 15-20 ft. Reddish-bronze leaves. Bright crimson flowers freely produced. One of the most conspicuous in bloom. Fruits small, purplish-red. Alternate bearer. Susceptible to apple scab. BA, DA, HY, LA, LC, LI, RO, WG, 1, 3, 38.

Malus 'Dorothea' (4)

Rounded tree to 20-25 ft. Deep pink semi-double flowers. Bright yellow fruits retained into winter. BT, IN, LA, LI, LN, LT, NE, RO, SH, VI, WG, WN, 4, 5, 6, 16, 21, 31, 34, 36, 42.

Malus 'Flame' (2)

Rounded tree to 20-25 ft. Flower buds pink, flowers fading white. Abundant red fruit. Annual bearer. FO, LT, KS, MK, RS, 11, 19, 32, 47.

Malus 'Hopa' (4-3B)

Tree to 20-25 ft. Greenish-bronze foliage. Flowers bright pink, freely produced. Deep red fruit, 2 inches wide, useful for jelly, but a possible nuisance on lawns. Alternate bearer. Susceptible to apple scab. CB, EA, EM, FA, HA, HY, KE, LT, PF, SH, ST, WB, WG, 5, 6, 16, 28, 31, 34, 36, 38.*

Malus 'Katherine' (4)

Tree to 15-20 ft. Flower buds pink, flowers turning white. Profuse large double flowers. Small yellow-red fruit. Annual bearer. CB, DA, EA, FO, LA, LI, LT, RO, SH, VI, WG, WN, 5, 6, 28, 29, 31, 24, 41, 42.

Malus 'Liset' (4)

Tree to 20-25 ft. Reddish-bronze leaves. Profuse purplish-red flowers. Fruits dark red. CO, ED, FE, FO, LI, SA, SH, 4, 5, 6, 29, 32.

Malus 'Radiant' (4)

Upright tree to about 25 ft. Flower buds deep red, flowers deep pink. Small bright red fruit. Annual bearer. Resistant to major crab-apple pests. BA, CB, EA, EM, HA, IN, KS, LI, LN, LT, RO, SH, 5, 6, 16, 19, 31, 32, 34, 42.*

Malus 'Red Jade' (4-3B)

Tree to about 15 ft. Branches spreading, weeping. Candidate for training to special forms. Needs specimen location. Suitable for tub plantings. Flowers single, pink in bud, opening white. Very profuse, small red fruit. Annual bearer, although there is slightly better fruit production in some years than others. Originated at Brooklyn Botanic Garden. BA, DA, FO, IN, KE, LI, LN, ML, OL, RO, VI, WG, WN, 1, 3, 5, 8, 21, 22, 29, 34, 42.

Malus 'Vanguard' (4)

Small upright tree of dense habit. Large rose-pink flowers, single. Red fruit, $\frac{3}{4}$ in. wide; persistent. Annual bearer. Resistant to most crab-apple pests. BA, BT, FA, FE, GU, LI, LT, MK, ML, RS, 6, 31.

China-berry

†Melia azedarach (7)

Round-headed tree to about 40 ft. Long clusters of fragrant purplish flowers in April-May. Small yellow berries persist into winter. Useful for wild-life plantings in mild climates. BH.

Sourwood, Sorrel-tree

Oxydendrum arboreum (4)

Tree to about 35 ft. in the North, taller

in the South. Rather narrow habit. Conspicuous drooping panicles of white flowers in July. Attractive seed pods contrast well with the brilliant autumn foliage. Acid soil. One of the most ornamental trees of the South, but hardy well into New England. ED, GA, HA, HE, HY, LA, LC, LI, LT, OL, PF, RO, SI, 1, 5, 6, 17, 21, 28, 42, 45.

Empress-tree

†*Paulownia tomentosa* (imperialis) (7-6B)

Fast-growing tree with large leaves. Coarse habit and usually short-lived. However, the 10-in. long pyramidal clusters of fragrant violet flowers are showy in early May. BR, 22.

Almond, Cherry, Peach

Prunus amygdalus (6)

ALMOND

Densely branched tree to 20 ft. Pink or white flowers in very early spring. BT, MA, VI, 11, 47.

†*Prunus avium* 'Plena' (4-3B)

DOUBLE-FLOWERED MAZZARD CHERRY

Dense pyramidal tree to 45 ft. or more. Abundant double-white flowers in late April. No fruits. Useful where Japanese flowering cherries are not hardy. LI, 29, 42.

Prunus 'Hally Jolivet' (5)

Very shrubby small tree, perhaps attaining 15 ft. at maturity. Diminutive leaves. Refined double-white flowers, pink in bud, in late April. Rather long bloom period. BA, LI, OL, RO, WG, WN, 5, 6, 25, 34, 35.

Prunus hillieri 'Spire' (incisa × *sargentii*) (5)

HILLIER SPIRE CHERRY

Narrow tree to 20-25 ft. Soft pink, single flowers in mid-April. Reddish autumn color. SH, 29.

Prunus maackii (2)

AMUR CHOKECHERRY

Rounded tree to 30 ft. or more. Handsome yellowish-brown, flaky bark; 2-3-in.-long racemes of white flowers in early May. DE, 29.

Prunus padus 'Commutata' (3)

MAY-DAY CHERRY

Small tree with rather open habit and drooping racemes of fragrant white flowers in mid- or late April. Early to leaf out. BA, DE, ED, RS, SH, 17.

Prunus pensylvanica (2)

PIN CHERRY

Short-lived but prolific small tree with attractive red bark. Racemes of small white flowers in late April. Useful for wild-life plantings in semi-naturalized land. DE, DU, FO, ML, SH, SN, VA.

Prunus persica 'Albo-Plena' (4)

DOUBLE WHITE-FLOWERED PEACH

Dense rounded tree to 15 ft. or more. Handsome flowers in mid-April. Fruit is usually produced on the double-flowered peaches, but it is inferior to that of named fruiting forms. Beware of borers. HA, MA, NE, WB, 4, 47. *Other Forms:* 'Roseo-Plena.' Double pink flowers. EA, GI, HA, MA, NE, WB, WG, 31, 37. 'Rubro-Plena.' Double red flowers. CA, KE, KR, MA, MU, NE, SQ, TE, WB, 4, 47.

†*Prunus sargentii* (4-3B)

SARGENT CHERRY

Upright tree to 50 ft. or more with rounded top. Flowers deep pink, single. Mid-April. Good autumn color. ED, FO, HE, LC, LI, LT, PF, RO, WN, 3, 5, 28, 29. *Selected Form:* 'Columnaris.' FO, LI, LT, 5, 29.

†*Prunus serotina* (3)

WILD BLACK CHERRY

A common tree in old fence rows over eastern part of North America. Useful in wild-life plantings. Drooping racemes of white flowers in mid-May. DU, FO, MU, PV, SN, TE, VA.

Prunus serrula (5)

RED-BARK CHERRY

Spreading tree, sometimes multi-stemmed, to about 25 ft. Superb glossy red bark. White flowers, single, in late April. Worth seeking out. BR, GO, WN, 17, 21, 29.

Prunus serrulata (5-4B)

JAPANESE FLOWERING CHERRY

Handsome tree usually growing to 20-25 ft. Of year-round interest because of growth habit, bark and flowers. Flowers, single or double, vary from white to yellow, pink and deep rose. Late April or early May. As with other *Prunus*, attention must occasionally be given to curb scale insects. The tree is best purchased in its named forms. *Selected Forms:*

'Amanogawa.' Columnar. Flowers light pink, semi-double, fragrant. DA, ED, FO, GO, LI, OL, RO, SH, WG, WN, 3, 21, 28, 29, 41, 42.

'Kiku-Shidare.' Double pink chrysanthemum-like flowers. SH, WE, 29, 42.

'Kwanzan.' Vase-shaped in youth, rounded at maturity. Large, deep pink flowers,

double. One of the hardiest and most satisfactory forms. More correctly known as 'Sekiyama.' CB, CO, ED, GI, GO, HA, LI, LT, PF, PT, RO, WG, ZI, 1, 5, 6, 20, 28, 31, 38, 42.*

'Shirofugen.' Flower buds pink, opening white. Double. FO, PF, PT, RO, 21, 28, 29, 42.

'Shirotae.' Flowers, semi-double or double, white. Especially pretty. CA, DA, GE, LI, ML, WG, 4, 21, 22, 28, 42.

'Sieboldii.' NADEN CHERRY. Light pink flowers, double. FO, WN, 29.

Prunus subhirtella (5-4B)

HIGAN CHERRY

Upright or rounded tree to 30 ft. or more. Abundant small light pink flowers in mid-April. Single. LT, 6, 15, 21, 28.

Selected Forms:

Var. autumnalis. Semi-double flowers, some appearing in fall, others in spring. Modest display. DA, EA, LI, RO, WN, 9, 17, 28, 42.

Var. pendula. Weeping. Flowers single. Be sure to stipulate single flowers when ordering, since some firms do not differentiate between this and the succeeding form. LA, LI, PF, PT, RO, SQ, VI, WB, WN, 3, 11, 15, 19, 20, 21, 41, 42.

'Yae-shidare-higan.' Weeping. Flowers double. BT, FO, CA, LC, MD, WN, 4, 9, 42.

Prunus yedoensis (5-4B)

YOSHINO CHERRY

Tree to 35 ft. or more. White-to-pink single flowers in mid-April. BT, DA, FO, GE, HA, ML, PF, PT, RK, 20, 21, 25, 28, 29, 38, 41, 42. *Selected Form:* 'Akebono.'

DAYBREAK CHERRY. Flowers soft pink. CA, DA, EA, ED, GO, WG, 4, 21, 29, 42

Other Prunus, see pages 15, 45, 61.

Epaulette-tree

Pterostyrax hispida (5-4B)

Tree to 35 ft. or more, with slender spreading branches. Long drooping panicles of fragrant creamy-white flowers in late May or early June. BR, RK, SH, 22, 44.

Pear

†Pyrus calleryana 'Bradford' (4)

BRADFORD PEAR

Broadly pyramidal tree to 45 ft. or more. Attractive white flowers in late April. Lustrous leathery foliage, often with good red autumn color. Fruits, when produced, small, inconspicuous. Resistant to fire

blight. BU, HA, HE, KE, KR, LI, LN, MB, RO, SA, ST, WN, 5, 7, 16, 21, 28, 34, 36, 44.

Locust, Black Locust

Robinia 'Idaho' (3?)

Open-growing tree to 40 ft. Dark reddish-purple flowers in pendulous clusters. Late May. LI, 29.

Robinia 'Monument' (cultivar or hybrid of R. hispida) (4)

Tree to 12-15 ft. Deep rose-pink flowers in late May. Pea-like. WG, 4.

Robinia pseudoacacia (3)

BLACK LOCUST

Tall, often sparsely branched tree with delicate light green compound leaves. The deeply ridged bark on older specimens has much character. Fragrant white pea-like flowers in late May. Highly esteemed in Europe, but plagued by borers and leaf-miner in eastern parts of the U. S. Rather weedy, but a tree that has merit where pests are not bothersome. CA, EM, FO, 11, 21, 39, 42, 47. *Selected Forms:*

'Descaisneana.' Flowers pink. CA, 30, 43.

'Pyramidalis' ('Fastigiata'). Narrowly columnar. FO, WG, 4, 21, 42.

'Tortuosa.' Slow-growing tree with short twisted branches. FO, WG, 4, 21, 42.

'Umbraculifera' ('Globosa'). Small tree with densely rounded head. Seldom flowers. BA, LI, 16, 29, 32, 42.

Wild China-tree

Sapindus drummondii (6)

Small tree with rounded crown and refined compound leaves. Loose panicles of creamy-white flowers in July are followed by yellow berries that finally turn black. Despite its common name, it is native to the south-central U. S. DU, 15.

Scholar-tree, Pagoda-tree

†Sophora japonica (4)

Tall tree with refined compound leaves. White pea-like flowers in mid-summer. In growth habit it more closely resembles the American elm than any other tree at the Brooklyn Botanic Garden. Avoid planting near paths because of its slippery seed pods. CB, DA, EA, GI, LI, LN, PF, RO, SI, WB, WG, WN, 3, 5, 14, 15, 21, 28, 36, 40, 42. *Selected Forms:*

'Pendula.' Picturesque weeping tree to 12-15 ft. The form in the trade is a sparse bloomer, but a good flowering form grows at Colonial Williamsburg. BR, OL, WA,

14, 15, 21, 29.

'Regent.' Flowers earlier in life than the species. LI, LN, MD, 5, 20, 28, 42.

Sorbaronia

Sorbaronia 'Brilliantissima' (*Sorbus aucuparia* × *Aronia arbutifolia*) (4)

Upright tree to 20 ft. or more. Leaves vary in shape on the same tree. Rather attractive clusters of small white flowers in mid-May. Berries purplish-red. GI.

Mountain-ash

†*Sorbus alnifolia* (5-4B)

KOREAN MOUNTAIN-ASH

Spreading, medium-sized tree with smooth gray bark. Simple, somewhat alder-like leaves. Orange-scarlet fruit in autumn. Good fall color. Borer-resistant. All of the mountain-ash trees cited here have moderately conspicuous, flat white flower clusters in mid-May. The fruits of most species will attract birds. BR, DU, LC, LI, 28, 29.

Sorbus americana (2)

Small, often shrubby tree with showy orange-to-red berries in autumn. Leaves compound. More selection work has been done with *S. aucuparia*, which is the most widely planted species. AE, DE, DU, ED, FO, MK, 15.

Sorbus aria 'Lutescens' (5)

GOLDEN WHITE-BEAM MOUNTAIN-ASH

Medium-sized, broad-pyramidal tree with yellowish foliage, whitish beneath. Leaves simple. Scarlet-red berries in autumn. ED, LI, RO. *Other Form:* *Sorbus aria* 'Majestica' ('Decaisneana'). Large fruit. Bright green leaves densely white beneath. SH.

Sorbus aucuparia (3)

EUROPEAN MOUNTAIN-ASH, ROWAN-TREE

Tree to 35-40 ft. with oval or rounded crown while young. Conspicuous white flower clusters in spring, showy orange-to-red berries in autumn. Very ornamental, but borer-prone in the East. Often short-lived. The refined compound leaves, unlike those of most European trees, have good red autumn color. BU, CB, CO, EM, FA, GI, KE, KS, MB, ML, MU, SR, WG, 3, 5, 7, 16, 31.* *Selected Forms:* 'Pendula.' Vigorous spreading small tree with pendulous branches. ED, OL, RI, SH, 29.

Several forms and hybrids exist with berries ranging in color from white to yellow and deep red. Available from: CO, ED, GI, IN, WG, WN, 5, 17, 29, 31, 36.

Sorbus decora (2)

SHOWY MOUNTAIN-ASH

Small northern tree closely related to



Marjorie J. Dietz

Sourwood or sorrel-tree (*Oxydendrum arboreum*) is a graceful, slow-growing tree with drooping panicles of white flowers in summer and red foliage in fall.

S. americana, but having larger fruit. DU, LC, SH.

Sorbus tianshanica (5)

TURKESTAN MOUNTAIN-ASH

Shrubby small tree to about 15 ft. Conspicuous white flowers and bright red fruit. Leaves compound. LI, WG, 10.

Stewartia

Stewartia koreana (5)

Pyramidal tree to 35-40 ft. This and the following species are often shrubby in youth. Handsome 3-in.-wide white flowers with yellow stamens. Late June. Beautiful flaking brown-to-cream bark. Orange-red autumn color. Worth seeking out. DA, GO, HY, PF, WA, 17, 22.

Stewartia pseudo-camellia (5)

JAPANESE STEWARTIA

Pyramidal tree to 45 ft. or more. Attractive white cup-shaped flowers in late June. Purplish autumn color. Distinctive cinnamon-colored peeling bark. BR, CB, DA, ED, GO, LI, PF, RO, VI, WG, 9, 17, 21, 28, 36, 40.

Snowbell

Styrax japonica (5)

JAPANESE SNOWBELL

Spreading small tree or tall shrub. Refined

foliage. Pendulous white bell-shaped flowers in late May. Dainty. It is valued for its excellent bark and trunk character at maturity. BR, DA, GO, MD, ML, PF, RO, RK, WN, 9, 15, 17, 21, 22, 28.

Styrax obassia (5-4B)

FRAGRANT SNOWBELL

Tree to 20 ft. or more. Fragrant white flowers in late May, partly obscured by the large leaves. Smooth gray, rather sinewy bark. BR, ED, GO, 15, 22.

Lilac

Syringa amurensis japonica (3)

JAPANESE TREE LILAC

Tree to 25-30 ft. Handsome cherry-like bark in youth. Loose upright panicles of white flowers in early June. Not fragrant. AH, BA, FO, IN, KS, LA, LI, LN, LT, PF, RO, SH, WE, WN, 5, 28, 29.

Other lilacs, see pages 51-52.

Yellow-horn

Xanthoceras sorbifolium (6-5B)

Small tree or shrub to 15-20 ft. Shiny, rather small compound leaves. Attractive white flowers in 10-in.-long upright racemes in mid-May. 22.



Roche

Flower bracts of Chinese or Kousa dogwood are pointed and appear in June.



Marjorie J. Dietz

The distinctive white flower panicles of the fringe-tree (*Chionanthus virginicus*).

EVERGREEN TREES

Broadleaf Evergreens

Strawberry-tree

Arbutus unedo (7)

Shrubby tree to 15 or 20 ft. Shiny 4-in. long leaves. Brownish-red peeling bark. Fruits strawberry-like, effective in autumn. Requires acid soil. BH, ML, PT, RI, 4, 30, 43, 44, 46. *Selected Form*: 'Compacta.' Dense shrub. RI, SI, 4, 23, 43, 44, 46.

Loquat

Eriobotrya japonica (7)

Shrubby tree to 15-20 ft. Long leathery leaves, and 6-in. flower panicles in autumn. Fragrant. Edible orange-yellow fruit. May be grown as a curiosity in protected sites as far north as New York City, but it is at home only in mild climates. BH, CA, PT, 4, 30, 43, 44, 46.

Eucalyptus

Eucalyptus niphophylla (7?)

SNOW GUM

Tree to 25 ft. or more with narrow bluish leaves. Peeling bark. Of interest as the hardiest eucalyptus at the University of Washington Arboretum in Seattle. GO, 26, 44. *Other species*: BH, PT, PY, 26, 30, 43, 44, 46.

Holly

Ilex aquifolium (6)

ENGLISH HOLLY

Dense tree to 35 ft. or more. Often shrubby in the North. Lustrous foliage, usually spiny. Red berries borne on pistillate ("female") plants, but staminate ("male") plants needed for pollination. While the tree benefits from summer sun, winter shade is advisable in the North. Very variable. English holly and its forms: BR, CA, CB, DA, EA, HY, MD, ML, PF, RO, SI, VI, WA, WO, 4, 20, 21, 22, 23, 26, 30, 33, 36, 40, 42, 43, 44, 46. *Selected Form*: 'Angustifolia' (7-6B). Leaves only ½ in. wide. Densely pyramidal small tree in the South; a small shrub with dense foliage habit on Long Island. Bonsai candidate. RF, RI, WA, 23, 42.

Ilex opaca (5-4B)

AMERICAN HOLLY

Evergreen tree to 35 ft. or more, some-

times shrubby. Dull green leaves. Red berries. A systemic insecticide, applied usually once or twice in the spring according to directions, easily controls the miner that often disfigures the leaves. CB, EA, EM, FO, HY, KE, KR, LT, NE, PF, RO, SQ, TE, VI, WB, 15, 20, 21, 28, 34, 35, 36, 38, 40. *Selected Form*: 'Xanthocarpa.' Pistillate form with yellow berries. CB, DA, WA, WO, 20. Other named forms: DA, GE, LI, MD, RK, SE, WO, 9, 12, 14, 41, 45.

Southern Magnolia

Magnolia grandiflora (7)

A striking evergreen tree, eventually to 60 ft. or more. Thick lustrous leaves 5-8 in. long. Fragrant large white flowers in summer. Occasionally grown in protected sites on Long Island, but best development occurs south of Philadelphia. A variable species with many named forms:

'Edith Bogue' (6B). Has retained its foliage over winter in New York City in better condition than other forms. No retail source known, but your local nurseryman can order plants for you from the wholesale firm Laurelwood Gardens, 736 Pines Lake Drive West, Wayne, New Jersey 07470. Unless you are a nurseryman, please do *not* order directly from this firm.

'Madison.' Long narrow leaves. DO.

'St. Mary.' Leaves conspicuously brown underneath. Flowers at an early age. GO, PT, 4, 12, 30, 43, 44, 46.

'Samuel Sommer.' Ascending branches. Large flowers. Rapid growth. GO, 43, 46.

Oak

Quercus ilex (7)

HOLM OAK

Broad tree to 45 ft. or more. Small leaves, unlobed and deep green in color, almost somber in effect. BH, ML, PT, 30, 43, 44, 46.

Quercus suber (7)

CORK OAK

Broad tree to 45 ft. or more. It provides the cork of commerce, but the thick and ridged bark is ornamental when the tree is grown as a landscape subject. Its leaves are small for an oak. ML, PT, RI, SI, 44.

Quercus virginiana (7)**SOUTHERN LIVE OAK**

Tree to about 50 ft. with stout spreading branches. Massive at maturity. Refined, narrow and unlobed leaves. GE, 12, 44. *For other oaks, see pages 15-16.*

Evergreen Elm**Ulmus parvifolia 'Pendens' (sempervirens) (5)**

Medium-sized, with drooping branches. Evergreen only in mild areas. BH, ML, PT, 30, 43, 44, 46.

Conifers**Fir****Abies amabilis (5)****CASCADE FIR, PACIFIC SILVER FIR**

Tall conical tree with shiny dark green needles. Like most firs, it grows best in regions with cool, humid weather. BR, ML, RI, SI.

Abies balsamea (3)**BALSAM FIR**

A popular Christmas tree. The fragrant balsam fir is most successful in cooler parts of the North. DA, GI, LI, ML, MU, PV, PW, RI, SI, VI, 21.

Abies cephalonica (5)**GREEK FIR.**

Splendid tree to 60 ft. or more. Sharply pointed spreading needles. Better in the mid-Atlantic states than most firs. BR, GI, RI, SI.

Abies cilicica (5)**CILICIAN FIR**

Handsome tree to 60 ft. or more. Shiny deep green, comb-like needles, pointed upward and forming a V-shaped depression along the twigs. Although few specimens are in cultivation, they appear well adapted to the often dry summers of the mid-Atlantic states. RF, 33.

Abies fraseri (4)**FRASER FIR, SOUTHERN BALSAM FIR**

Much like the balsam fir, but somewhat better suited to moderate-climate gardens. Unsatisfactory on Long Island. BR, GD, LA, ML, MU, RI, RK, SI, WN, 3, 19, 21, 38, 39.

Abies grandis (6)**GRAND FIR, VANCOUVER FIR**

A giant among firs; in fact, one of the tallest-growing trees of North America. Shiny dark green, comb-like needles. BR, RI, SI, 24.

Abies homolepis (4)**NIKKO FIR**

Attractive tree to 65 ft. or more. Shiny green needles, whitish beneath. More successful in the mid-Atlantic states than most firs. AL, GI, LI, ML, RF, SH, SI.

Abies koreana (5)**KOREAN FIR**

A small fir to 50 ft. BR, SH, WA.

Abies lasiocarpa (2)**SUB-ALPINE FIR**

Very narrowly pyramidal tree with a wide distribution in the mountains of western North America. Picturesque, but apparently needs cool, evenly moist climate to perform well. BR, RF, RI, VA, WI, 42.

Abies lasiocarpa arizonica (6)**CORK-BARK FIR**

Tree to about 45 ft. Bluish-green needles. BH, RI, SI, 15, 38, 39.

Abies magnifica (5)**CALIFORNIA RED FIR**

Narrowly pyramidal tree to 90 ft. or more. Remarkably short and stiff horizontal branches arranged in tiers. RF, RI, SI. *Selected Form: Var. shastensis.* MT. SHASTA FIR. A smaller tree. RF, RI, SI, WI.

Abies nordmanniana (4)**NORDMANN FIR**

Tall tree from the Caucasus. Needles shiny green above, whitish beneath. Like most firs, most attractive while young. BR, CB, DA, EA, LA, LI, RI, RO, SI, 4, 10, 15, 22, 28.

Abies pinsapo (6)**SPANISH FIR**

Handsome tall tree with rigid needles, densely arranged around the branchlets and extending far down the older wood. BR, GO, 39. *Selected Form: 'Glaucula.'* Needles blue. BR, DA, PK, RF, RI, SI, 4, 15, 21, 33, 38.

Abies procera (nobilis) (5)**NOBLE FIR**

Tall tree native to the Pacific Northwest. Bluish-green needles. BR, ML, RF, RI, SI, 24, 33, 39, 42. *Selected Form: 'Glaucula.'* Needles blue. BR, CB, DA, WA, 15, 38.

Abies veitchii (3)**VEITCH FIR**

Attractive fir from Japan. Shiny dark green needles, strikingly white beneath. BR, DA, GI, LI, ML, RF, RI, SH, SI, 15.

Monkey-puzzle Tree**Araucaria araucana (imbricata) (7)**

Oval tree to 50 ft. or more, with twisted

rope-like branches. Unique—and for that reason—difficult to use in the landscape. BR, RF, SP, 22.

California Incense-cedar

Calocedrus (Libocedrus) decurrens (5)

Tall tree, usually narrowly columnar in cultivation. Aromatic scale-like needles somewhat resemble those of arbor-vitae. BR, CA, ML, PT, RF, RI, RO, SI, 22, 33, 39, 41, 42, 43, 44.

Cedar

Cedrus atlantica (6)

ATLAS CEDAR

Tall-growing tree from the Atlas Mountains of Morocco and Algeria. Often short-trunked and spreading with age. Greenish-blue needles are clustered along the branchlets. This and its selected forms (below), especially 'Glaucæ,' are choice bonsai candidates. PF, PT, RO, SI, 30, 39, 43, 44, 46.

'Argentea.' SILVER ATLAS CEDAR. RF, SP.

'Aurea.' GOLDEN ATLAS CEDAR. BR, PF, RO, SP, WA, 15, 17, 38, 44.

'Fastigiata.' COLUMNAR ATLAS CEDAR. DA, KI, RF, 15, 38.

'Glaucæ' (6-5B). BLUE ATLAS CEDAR. BH, BR, CB, DA, GI, HY, KI, MD, OL, PF, PT, RF, RO, VI, WA, WN, 4, 9, 15, 17, 20, 21, 22, 28, 30, 33, 35, 38, 40, 41, 42, 43, 44, 46.

'Glaucæ Pendula.' WEEPING BLUE ATLAS CEDAR. Slow-growing to about 12 ft., and broader than tall. Stake while young. BR, OL, PA, PK, RF, SP, VI, WA, 4, 15, 21, 33, 35, 38, 42.

Cedrus brevifolia (7-6B)

CYPRESS CEDAR

Very small slow-growing tree, seldom to more than 12 ft. in cultivation. Short densely arranged needles. AL, KI, RF, SP.

Cedrus deodara (7)

DEODAR CEDAR

Tall spreading tree from the Himalayas. Weeping branchlets and 2-in.-long needles. Shapely in youth, superb at maturity. BH, CB, DA, EA, GE, GI, ML, PT, RI, SI, WB, 11, 17, 20, 23, 26, 30, 33, 36, 38, 39, 42, 43, 44, 46. *Selected Form:* 'Kashmir.' Hardy to Zone 5. KI, 15, 22, 28, 38.

Cedrus libani (6-5)

CEDAR OF LEBANON

The cedar of the ancients—striking in old age with flat top and horizontal branches. Var. *stenocoma* is hardier than

the species, but it is not usually distinguished in the trade. BR, CB, DA, EA, GI, RO, SI, 15, 17, 20, 22, 23, 28, 38. *Selected Form:* 'Pendula.' Small tree with intensely pendulous branches. Stake while young. Not to be confused with 'Sargentii,' a weeping dwarf shrub (see p. 76). 22, 38.

False-cypress

Chamaecyparis lawsoniana (6-5)

LAWSON-CYPRESS

An exceedingly variable species—some 200 forms, mostly dwarf, are known. Native to a relatively small area in northern California and southern Oregon, where it is called Port Orford cedar. More satisfactory in Europe than in many parts of the U. S. Branchlets frond-like. Foliage often bluish-green. Some trees may grow to 100 ft. or more. 21, 40. *Selected Forms:*

'Allumii.' Compact columnar tree with steel-blue foliage. Best while young. DA, MA, RF, WN, 11, 23, 36.

'Fletcheri.' Dense, pyramidal, to about 15 or 20 ft. Feathery gray-green foliage. SP, WA, 1, 23.

'Triomphe de Boskoop.' Pyramidal, to 30 ft. or more. Stiff steel-blue foliage. Named for a town in Holland noted for its many nurseries. RF.

Chamaecyparis nootkatensis (4)

NOOTKA-CYPRESS, ALASKA-CEDAR

A striking conifer from the mountains of the northwestern U. S. and Canada. Ultimately tall-growing. Most trees have notably pendulous branches. ED, SI, 33, 39. *Selected Forms:*

'Glaucæ.' Bluish foliage. SH, WA.

'Pendula.' Differs little from the species as it is found in the higher reaches of the Cascade Mountains of Washington. However, non-pendulous forms exist, and this purported cultivar is included for those who wish to be sure of receiving a weeping Nootka-cypress. It is not a dwarf. BR, KI, OL, RF, SH, SP, 8, 23.

Chamaecyparis obtusa (4-3B)

HINOKI-CYPRESS

Slow-growing conifer with dark green scale-like leaves. In time a large tree. Requires acid soil. This and Sawara-cypress have few insect pests. Both, in their multitudinous forms, are used extensively in bonsai. DA, ML, PT, RI, SI, 23, 39. *Selected Forms:*

'Crippsii.' Golden foliage. Slow-growing to about 15 ft. BR, SI, SP, WA, WF, 1, 10, 15, 22, 23, 33, 36, 38.

'Gracilis.' Dense slow-growing form of

Hinoki-cypress. Pendulous branchlets. A small graceful tree. BR, HY, KI, PK, RO, VI, WA, WF, WN, 15, 17, 23, 33, 35, 38, 41, 42, 44.

hamaecyparis pisifera (3)

SAWARA-CYPRESS

A variable species with many garden forms, some of which are dwarf. Sawara-cypress itself may attain 75 or 100 ft. Somewhat more tolerant of soil conditions than Hinoki-cypress, but most satisfactory growth occurs in moist climates. GE, LC, 2. *Selected Forms:*

'Boulevard' ('Cyano-Viridis'). When well grown in a moist climate, this is a very attractive small tree with striking silvery-blue, feathery foliage. Eventually to 12 ft. or more. AL, BT, DA, ED, GI, KI, MF, ML, PK, PT, RI, RO, SI, WA, WN, 13, 14, 19, 20, 21, 23, 33, 36, 38, 41, 42, 44, 46. 'Filifera.' THREAD-LEAF-CYPRESS. To 60 ft. or more, with delicate whip-like branchlets. Often wider than tall. AL, ED, HY, KI, LT, MA, PF, RO, WN, 23, 36, 42.

'Plumosa.' PLUME-CYPRESS. Of good tree size. Delicate frond-like branchlets. BR, DA, ED, GE, HY, LT, PF, SI, WN, 2, 9, 23.

'Squarrosa.' MOSS-CYPRESS. Small feathery silver needles. Ultimately a large tree. BR, EA, FO, GE, WF, 2, 9, 23.

Chamaecyparis thyoides (3)

ATLANTIC WHITE-CEDAR

Pyramidal tree of East Coast marshlands. May grow to 75 ft., usually much less in gardens. Spire-like crown. Less attractive than other *Chamaecyparis*, but tolerant of moist soils. BR, OL, WN. *Selected Form:* 'Glauc.' 33.

Cryptomeria

Cryptomeria japonica (6)

Tall pyramidal tree, often with short branches. Somewhat open at maturity. Young trees are shapely, old ones picturesque. A variable species, and this variability extends to hardiness. BH, BR, CB, DA, EA, MD, ML, RO, 15, 19, 20, 21, 22, 36, 41. *Selected Form:* 'Elegans' (7-6B). Feathery foliage distinct from the species. Small tree, often aging poorly. BH, RF, SP.

China-fir

Cunninghamia lanceolata (7)

Striking tree with stout, shiny green needles, 2-in. long, arranged along the branchlets like the teeth of a comb. So distinct from other conifers that it is

difficult to use in the landscape. Ultimately a large tree. BH, BR, EA, GE, MD, RF, RO, WA. *Selected Form:* 'Glauc.' Blue needles. BR, MD, RF, SP.

Leyland-cypress

Cupressocyparis leylandii (6B)

A fast-growing bigeneric hybrid (*Cupressus macrocarpa* × *Chamaecyparis nootkatensis*) that has in recent years been widely planted in Europe, where several forms are known. Foliage resembles Nootka-cypress, but the tree is densely pyramidal. 90-ft. specimens exist in England. BH, CB, SS, 17, 30, 36, 43, 44, 46.

Cypress

Cupressus arizonica (7)

ARIZONA CYPRESS

Broadly pyramidal tree with gray or gray-green scale-like leaves. Eventually to 60 ft. or more. Attractive deep cherry-red bark. BH, ML, PT, SI, 30, 43, 44, 46.

Selected Forms:

'Gareei.' Hardier than the species. 11, 15, 44.

'Pyramidalis.' 30.

Cupressus bakeri (5)

MODOC CYPRESS

Slow-growing small bushy tree with bluish-green scale-like leaves. Native to Oregon, it is the hardiest of the true cypresses (*Cupressus*) and has succeeded as far north as Boston. BR, WA.

Cupressus macrocarpa (7)

MONTREY CYPRESS

A picturesque tree associated with the Monterey Peninsula of California. Satisfactory in warm coastal areas, where it is frequently used as a clipped hedge. Ultimately to 60 ft. or more. PT, 30, 46.

Cupressus sempervirens var. sempervirens ('Stricta') (7)

ITALIAN CYPRESS

The most narrowly fastigiate of the tall evergreens—and a characteristic tree of the Mediterranean coast. Despite its curious nomenclature, it is a cultivar. Usually sold as *C. s.* 'Stricta.' PT, 12, 13. *Selected Form:* 'Glauc.' BH, PT, 30, 44, 46.

Juriper

Juniperus chinensis (4)

CHINESE JUNIPER

A very variable species. Some forms are narrow trees growing to 45 ft; others are spreading shrubs only a few feet high.

Generally grayish-green to green foliage, Scale-like or awl-shaped. Usually sold in its forms. *Selected Forms:*

'Columnaris' ('Pyramidalis'). Narrow, to 25 ft. or more. Sharp, awl-shaped needles. DA, GI, IY, RO, WN, 2, 28.

'Kaizuka' ('Torulosa'). HOLLYWOOD JUNIPER. Broad shrubby tree to 15 ft. or more. Twisted branching is unique. Less formal than other large Chinese junipers. BH, BR, IY, KI, LA, LI, MA, ML, PK, PT, RF, RO, SP, WA, WN, 4, 12, 13, 15, 16, 21, 23, 30, 33, 38, 42, 43, 44, 46.

'Keteleeri.' Pyramidal, to about 30 ft. Green scale-like needles and $\frac{1}{2}$ -in.-wide blue berries. Often listed under *J. virginiana*. CO, EA, GI, HY, LC, LI, ML, NE, RO, SA, SII, WN, 2, 6, 9, 10, 11, 13, 15, 16, 25, 30, 31, 43, 44.

'Mas.' A tall, free-flowering, densely columnar form with predominantly awl-shaped needles. The sexes are borne separately on most junipers, and this is but one of a number of staminate forms. LI.

'Mountbatten.' Narrowly columnar form with gray-green needles that are mostly awl-shaped. Dense, free-fruiting. BA, CO, DA, KI, LI, RF, SII, WE, WN, 11, 15, 16, 21, 32, 44.

'Obelisk.' Narrowly pyramidal, probably to 12 ft. or more. BA, CO, KI, RF, WE, 30.

'Robusta Green.' (4)

Tufted column to 15 ft. or more. Sinuous branching; less rigid than most upright Chinese junipers. Different. IIE, HY, LI, MD, RF, RO, 19, 21, 42, 43, 44.

Juniperus communis suecica (4-3B)

SWEDISH JUNIPER

Columnar, often narrowly columnar. May ultimately grow to 40 ft., usually much lower in gardens. Dense, with nodding shoot tips. Bluish-green. It is a botanical variety and some variation occurs. CO, EA, ED, SII.

Juniperus recurva coxii (7)

COX JUNIPER

In cultivation, eventually a medium or large-sized tree with delicate weeping branches and rich green foliage. Rather open and spreading in habit. Sometimes cited as *J. coxii*. AL, RF, SP.

Juniperus rigida (5)

NEEDLE JUNIPER

A graceful small, more-or-less pyramidal tree with pendulous branchlets. Not as stiff in appearance as upright Chinese juniper forms. AL, BR, PA, PK, RF, SP, WA.

Juniperus scopulorum (5-4)

WESTERN RED-CEDAR, ROCKY MOUNTAIN JUNIPER

A variable species, some trees growing to 35 ft. or more. Many silvery-blue pyramidal forms, differing slightly in hardness, have been selected in recent years by mid-western nurseries. GI, NE, PV, VA. *Selected Forms:*

'Blue Heaven.' Pyramidal. Free-fruiting. BA, CO, DE, GI, HY, KI, KS, ML, PT, PV, RF, SH, WE, 15, 16, 30, 31, 40, 42. 'Chandler Blue.' One of the hardest blue pyramidal forms. BA, GI, 6, 30.

'Cologreen.' Light green upright form. BA, FE, KS, PV, 30, 31.

'Gray Gleam.' Staminate form with foliage especially gray in winter. RF, SP, WA, 42.

'Pathfinder.' Pyramidal, silvery light green. BH, PT, RF, WA, 30, 31.

'Welchii.' Silver-gray in youth. BA, FE, ML, PV, RF, RS, 15, 16, 31, 32.

Juniperus virginiana (3-2)

EASTERN RED-CEDAR

Usually a medium-sized pyramidal or columnar tree in cultivation. Much variation occurs, and countless forms have been named over the years. CO, DE, EA, GE, GI, GU, LT, PV, RI, SII, SI, WN, 6, 10, 12, 21, 22. *Selected Forms:*

'Burkii.' Conical, with blue foliage. Very hardy. CO, ED, LC, LI, SH, SQ, WE, WN, 2, 15, 16, 30, 31, 41, 43.

'Canaertii.' Densely pyramidal, with dark green foliage. Unlike many red-cedars good green color retained in winter. Free-fruiting. CO, DA, EA, GI, IY, LC, LI, LN, MK, NE, SA, SH, SQ, WA, WB, WN, 2, 9, 11, 15, 16, 21, 22, 32, 41.

'Glaucia.' Narrowly columnar, to about 20 ft. Bright blue. CO, DA, GI, LA, LI, NE, SH, SQ, WN, 2, 9, 11, 15, 16.

'Skyrocket.' Thin column to 10-12 ft. Much like a diminutive Italian cypress. Blue-green. ED, PA, PK, SH, WA, WE, 15.

Incense-cedar

Libocedrus decurrens. See *Calocedrus*.

Spruce

Picea abies (excelsa) (2)

NORWAY SPRUCE

Tall tree with drooping branchlets. Attractive while young, but seldom ages gracefully. Somber. Needs much room for proper development. Most nurseries. *Selected Forms:*

'Inversa.' DROOPING NORWAY SPRUCE. An odd, sometimes striking form. Narrow, intensely pendulous. Eventually to about 30 ft. BR, DA, KI, PA, RF, SP, VI, 38.

'Pendula.' WEEPING NORWAY SPRUCE. A collective group of weeping forms. Stake this and the preceding while young. GO, KI, MD, OL, PA, RA, RF, RO, SP, VI, WN, 21, 23, 33, 35, 38, 40.

***Picea breweriana* (5)**
BREWER OR SISKIYOU SPRUCE
 Distinctive tree with weeping branchlets and gray-green needles. Needs cool moist atmosphere. Slow-growing, with few cultivated specimens over 35 ft. BR, RF, RI, SI, SP, WA, WI.

***Picea engelmannii* (2)**
ENGELMANN SPRUCE
 Much like Colorado blue spruce but with soft needles. EA, GI, LI, ML, RI, SI, 3, 10, 15, 24, 33. *Selected Form:* 'Glauca.' 38.

***Picea glauca* (alba, canadensis) (2)**
WHITE SPRUCE
 Tall tree, often with light blue-green needles. Handsome in youth. CO, DE, EA, EM, FA, FE, GI, LI, LT, ML, MU, PV, RO, SH, SI, VA, WB, 7, 35. *Selected Form:* **Var. densata** (3). Slower-growing and more compact. BA, GI, LC, LN, MB, MK, ML, MU, PV, RI, RO, SA, SI, 3, 6, 7, 10, 16, 19, 24, 31, 32, 39, 42.

***Picea omorika* (4-3B)**
SERBIAN SPRUCE
 Narrowly pyramidal tree to about 75 ft. Striking at maturity. Needles dark green with bluish underside. BR, CO, DA, LA, LC, LN, ML, MU, PF, RI, RO, SH, SI, 7, 15, 21, 22, 23, 28.

***Picea orientalis* (4)**
ORIENTAL SPRUCE
 Graceful tall spruce from Asia Minor. Very short, dark green needles. Refined. CB, DA, KI, RO, SI, 15, 22, 23.

***Picea pungens* (3-2B)**
COLORADO SPRUCE
 Tall tree with green or bluish-green needles that are sharp to the touch. More adaptable to dry summers than are most spruces. Best not grown near Douglas fir because of gall aphid association. AE, BA, BH, BU, CO, DA, DE, ED, FE, GD, LA, LI, LN, LT, MA, MK, NE, PF, PT, PV, PW, RO, RS, SH, SI, SQ, WE, WN, 3, 5, 6, 10, 16, 19, 28, 31, 32, 35, 42.

***Picea pungens* 'Glauca' (3)**
COLORADO BLUE SPRUCE
 A well known tree, attractive for a few years, but often aging poorly. Many forms

have been selected for especially blue needles. *Selected Forms:*

'Glauca Pendula.' WEEPING BLUE SPRUCE. Narrow, with intensely pendulous branches. Stake while young. BR, CB, DA, KI, ML, OL, RF, VI, WF, 8, 15, 38, 40.

'Hoopsii.' One of the bluest of blue spruces. BR, DA, GI, KI, ML, OL, PF, SA, VI, WN, 7, 15, 22, 23, 33, 36, 38, 40.

'Koster.' Silvery. One of the best. AE, CB, CO, DA, EM, GI, KI, LC, LI, MD, MK, ML, RO, SH, VI, WN, 2, 9, 16, 21, 28, 36, 38, 41, 42.

'Moerheimii.' Dense, compact. Steel-blue. BA, BR, CB, EA, GI, KI, LI, MD, ML, PF, PV, SA, 15, 21, 36, 38, 42.

***Picea sitchensis* (6)**

SITKA SPRUCE

A splendid immense spruce of the North Pacific Coast. When the needles are seen in a certain light, they contain the shimmering beauty of an ice storm. Grows well in very sandy soil but demands a moist atmosphere. Not generally successful in the eastern U. S. BR, ML, RF, RI, SI.

***Picea torano* (polita) (5)**

TIGER-TAIL SPRUCE

A tall Japanese spruce with lustrous dark green, often curved needles that are very sharp to the touch. KI, RF.

Pine

***Pinus armandii* (5)**

Tree to 45 ft. or more, somewhat like *P. strobus*, but with slightly longer needles, more open habit at maturity and distinctly horizontal branching. BR, RF.

***Pinus banksiana* (2)**

JACK PINE

A rather coarse but picturesque tree with short needles arranged in pairs. Usually scrubby but occasionally to 50 ft. or more in the wild. Suitable for form-training in cold areas. Grows better on dry, gravelly slopes than most other pines. LI, OL, RF, RI, SI, WN, 15, 23.

***Pinus bungeana* (4)**

LACE-BARK PINE

Slow-growing, eventually to 40-50 ft. Needles arranged in threes. Attractive exfoliating bark as the tree matures. Usually multi-stemmed. BR, CB, DA, KI, LI, MD, OL, PF, RF, WA, 15, 22, 28, 38.

***Pinus cembra* (3)**

SWISS STONE PINE

Slow-growing pyramidal or columnar tree, usually to not more than 30 ft. in gardens. Dark green needles arranged in fives. Habit

of the Swiss stone pine is dense. CB, DA, HY, KI, LA, MU, OL, PF, PK, RF, RO, VA, VI, WA, WN, 2, 15, 17, 21, 22, 38.

Pinus cembroides edulis (P. edulis) (4)

PINYON OR NUT PINE

Slow-growing, shrubby pine of the American Southwest, with needles generally in pairs. Somewhat coarse, but older specimens often have character. Of interest as one of the pines with edible seeds. BH, BR, IE, KS, ML, PV, RA, RF, RI, RO, SI, WN, 23, 33, 39.

Pinus cembroides monophylla (5)

SINGLE-NEEDLE PINYON PINE

Flat-topped, shrubby tree, remarkable among pines for its solitary needles. BR, RF, RI, SI, 38.

Pinus contorta (7)

SHORE PINE

Small tree generally with dense head, but assuming many different shapes along the windswept North Pacific Coast. Short, twisted, deep green needles in pairs. DA, ED, GI, KI, RF, RI, SI, WA, 15, 23, 39, 42.

Pinus contorta latifolia (5)

LODGE-POLE PINE

Eventually a tall tree. Short, twisted needles in pairs. The most common pine of the Northern Rocky Mountains. DE, ML, RI, SI, VA, 24, 33, 39.

Pinus densiflora (4)

JAPANESE RED PINE

Tall, asymmetrically spreading tree with orange-brown bark. Needles in pairs. BI, GI, KI, LI, ML, RI, RO, SI, 15, 23, 36, 38, 39. *Selected Forms:*

'Oculus-draconis.' DRAGON'S EYE PINE. Needles part yellow, part green. OL, PK, RF, SP, WA, 15, 35.

'Umbraculifera.' TANYOSHO PINE. Densely shrubby while young, ultimately an umbrella-shaped tree to 10 ft. or more. AL, BR, CB, DA, GI, KI, LI, OL, PA, PT, RF, RO, SP, VI, WF, WN, 8, 15, 16, 21, 22, 38, 42.

Pinus flexilis (2)

LIMBER PINE

Slow-growing, eventually a tall tree. Rather short needles arranged in fives. Native to much of the American West. BR, GI, KI, LI, LN, ML, OL, PV, RF, RI, RO, VA, WA, 16, 22, 33. *Selected Form:*

'Glauc.' BR, DA, KI, OL, WA, 15, 38.

Pinus halepensis (7)

ALEPPO PINE

A coarse two-needle pine with broadly rounded head at maturity. Tolerant of drought, poor soil and sea-side conditions

in mild climates. BH, PT, PY, SI, 26, 30, 43, 44, 46.

Pinus jeffreyi (5)

JEFFREY PINE

Tall-growing pine from Oregon and California. Rather long, bluish-green needles arranged in fives. Closely allied to ponderosa pine. BR, LI, MD, ML, RI, SI, 23, 33, 39, 42.

Pinus koraiensis (3)

KOREAN PINE

Slow-growing, asymmetrically spreading tree with deep green needles grouped in fives. Seldom over 50 ft. in gardens. Old specimens often picturesque. KI, MD, WA, WI, 15, 33.

Pinus lambertiana (5)

SUGAR PINE

The tallest-growing of all pines, with occasional specimens in the Northwest well over 200 ft. Growth slow, often narrow. It is a five-needle pine. BR, RI, SI, 39.

Pinus monticola (5)

WESTERN WHITE PINE

Much like *P. strobus*, but more narrowly symmetrical. OL., RF, VA, WN, 39.

Pinus muricata (7)

BISHOP PINE

Tree to about 30 ft., pyramidal in youth, round-headed at maturity. Native to the California coast. RI, SI, 44, 46.

Pinus nigra var. nigra (P. austriaca) (4)

AUSTRIAN PINE

To 75 ft. or more, with spreading branches and stiff, dark green needles in pairs. Attractive rough deep-cinnamon bark. More tolerant of city conditions than most pines. BA, CO, DA, ED, FA, FE, GE, GI, IE, KE, KS, LI, LT, MA, ML, MU, NE, PF, RI, RO, RS, SI, WB, 10, 11, 15, 16, 20, 21, 32, 24, 28, 39, 42.*

Pinus palustris (australis) (7)

LONG-LEAF PINE

Tall forest tree of the Deep South. Remarkably long (9-18 in.) needles arranged in threes. Its habit is graceful and distinct. GE, 23.

Pinus parviflora (pentaphylla) (5)

JAPANESE WHITE PINE

Handsome tree with short needles grouped in fives. Generally slow-growing. Densely compact while young, broadly spreading at maturity. Seldom over 45 ft. in gardens. Variable, but usually beautiful. Bonsai. BR, GI, LI, OL, WN. *Selected Form:* **'Glauc.'** AL, BR, CB, DA, KI, MD, PA, PF, PK, RF, RO, WA, 15, 17, 28.

Pinus peuce (4)**MACEDONIAN PINE**

Slow-growing five-needle pine. Dense. A columnar or narrowly pyramidal tree seldom over 30 ft. in gardens. BR, KI, MU, RF, SI, 15, 38.

Pinus pinaster (7)**CLUSTER PINE**

Tall pyramidal tree from the Mediterranean region. Well adapted to coastal sites. Rather long bright green needles in pairs. BH.

Pinus pinea (7)**ITALIAN STONE PINE**

Tall umbrella-shaped tree, characteristic of the Mediterranean countryside. Cultivated since early times for its edible seeds (called "pine nuts"), a staple of Middle Eastern cookery. BH, PT, SI, 26, 30, 43, 46.

Pinus ponderosa (5)**PONDEROSA OR WESTERN YELLOW PINE**

Tall, open and fast-growing tree, often with long needles, usually grouped in threes. Native to a large part of the American West. Plated, reddish-brown bark on old trees is attractive. FE, HE, KS, LC, LI, LN, MU, PV, RI, SH, SI, VA, WN, 23, 24, 39, 42.

Pinus radiata (7)**MONTEREY PINE**

A beautiful, irregularly spreading tree at maturity, slightly resembling an old cedar of Lebanon, but with a rounded head. This pine of the California coast has bright green needles arranged in threes. BH, PT, PY, SI, 4, 26, 30, 43, 46.

Pinus resinosa (2)**RED OR NORWAY PINE**

Tall tree similar to Austrian pine, but having flexible needles. Best in the cooler parts of the Northern U. S. and adjacent Canada, where it is native. Grows poorly in New York City. EA, FE, GD, GI, LA, LC, LI, LT, MK, ML, MU, PW, RI, RS, SI, WN, 3, 6, 7, 11, 15, 21, 23, 33, 36, 39, 42.

Pinus sabiniana (6)**DIGGER PINE**

Medium-sized tree from California with long grayish-green needles in threes. Sparse open picturesque habit at maturity. Named for the Digger Indians. One of the pines with edible seeds. SI.

Pinus strobus (3-2B)**EASTERN WHITE PINE**

A beautiful, eventually tall-growing tree of eastern North America. Bluish-green or

green needles in fives. Often picturesque at maturity. Highly susceptible to air pollutants, but variability extends even to this. EA, ED, GI, HE, HY, LV, LI, LT, MK, ML, MU, NE, PF, SH, VI, WB, WE, WN, 6, 7, 10, 11, 15, 20, 21, 23, 28, 35, 38, 39, 40, 41.* *Selected Forms:*

'Fastigiata.' Columnar while young. BR, CB, DA, FO, KI, MD, OL, PA, PF, RF, RO, WA, WN, 8, 15, 35, 38.

'Pendula.' Weeping, never attaining a good tree size. Stake while young. BR, CB, DA, KI, MD, OL, PA, PF, PK, RF, RO, VI, WA, WF, WN, 8, 15, 16, 17, 35, 38, 40.

Pinus sylvestris (2)**SCOTS PINE**

A variable two-needle pine growing to about 75 ft. Slightly coarse gray-green needles. Attractive orange bark and sparse habit when fully grown. AE, BA, BH, CO, FE, GI, KE, KS, LI, LN, LT, MK, ML, MU, PV, RI, RO, SI, WB, ZI, 6, 10, 16, 19, 21, 23, 24, 33, 39, 42.*

Selected Forms:

'Argentea.' Needles silvery-blue. AL.

'Fastigiata.' COLUMNAR SCOTS PINE. BA, BR, KI, OL, RF, VA, 16, 38.

Pinus thunbergii (5)**JAPANESE BLACK PINE**

Medium-sized tree with distinctively asymmetrical habit. Dark green needles in pairs. One of the best conifers for sandy soil and seaside conditions. Bonsai. BH, BT, EA, GE, HE, HY, LI, LT, ML, MU, PF, PT, RI, RO, SI, WB, WN, 4, 9, 15, 19, 21, 26, 34, 30, 38, 39, 40, 42, 43, 44, 46.

Pinus wallichiana (griffithii, excelsa) (6)**HIMALAYAN PINE**

Tall tree resembling eastern white pine, but with long drooping needles. Bluish-green. Striking, graceful. BH, CB, DA, EA, MD, ML, PA, PF, RI, RK, SI, VI, 15, 22, 23, 39, 44.

Podocarpus**Podocarpus macrophyllus (7)****YEW PODOCARPUS**

Attractive, usually shrubby tree from Japan and China, eventually to 20-25 ft. Deep green 1/2-in. wide leaves. Often used as hedge in warm climates. PT, 4, 30, 43, 44, 46. *Selected Form:* 'Maki.' RI, 12, 13, 30, 43, 44, 46.

Podocarpus nagi (??)**JAPANESE PODOCARPUS, MAKINO**

Eventually a large tree with smooth purple

bark. Leaves wider and longer than in the preceding. PT, 30, 46.

Douglas-fir

Pseudotsuga menziesii (taxifolia, douglasii) (7-4)

A famous—and variable—timber tree of Western North America (often listed as *Abies douglasii*). Northern nurseries usually sell the hardy Rocky Mountain variety *glauca* (sometimes calling it such, more often not), which is not necessarily bluish in appearance. The attractive deep green, fast-growing Pacific Coast variety *viridis* is not reliably hardy in the Northeast. Neither should be grown near Colorado spruce (*Picea pungens*) because of gall aphid association. BA, EM, FA, FE, GI, HY, LI, LT, ML, MU, PF, RI, RO, SJ, WN, 5, 7, 15, 16, 19, 21, 24, 28, 41.* *Selected Forms*:

'Fastigiata.' Conical, with strongly ascending branches. BA, FO, LI, RF, 16, 21, 38.

'Pendula.' Drooping branches. This and the preceding are hardy forms. BR, CB, KI, RF, VI, 15, 38.

Var. *viridis*. See above. RI, SI.

Japanese Umbrella-pine

Sciadopitys verticillata (5)

Slow-growing pyramidal tree, attaining perhaps 40 ft. after many years. Remarkable for its united needles, lustrous deep green. Dense while young, usually open at maturity. AL, BR, CB, DA, HY, KI, ML, OL, RA, RF, RO, SP, VI, WA, WN, 8, 22, 35, 38, 41.

Redwood

Sequoia sempervirens (7)

The tallest-growing tree of North America native to only the mild California coast. Not for every garden, and certainly not for the Northeast, but in mild climates with a constantly humid atmosphere, redwood can be a magnificent tree. BH, CA, ML, PT, SI, 26, 30, 43, 44, 46.

Giant-sequoia, Big-tree

Sequoiadendron giganteum (Sequoia gigantea) (6)

The most massive, although not the tallest tree of North America. Native to the Sierra Nevada of Eastern California. Hardier than the redwood and occasionally grown even in southern coastal New England. BR, CA, DA, FO, ML, PT, RI,

SI, VI, WA, 26, 30, 39, 46.

Arbor-vitae

Thuja occidentalis (3-2)

AMERICAN ARBOR-VITAE

Medium-sized pyramidal tree with scale-like leaves. Stiffly formal. Grows better in moist soil than most other conifers. Tolerates light shade. About 127 forms, including shrubby, globose ones, have been selected over the years. They are slightly less hardy than the species. CO, DA, EA, ED, FE, FO, GE, GU, LN, ML, MU, PW, SQ, 33. *Selected Forms*:

'Fastigiata' ('Pyramidalis'). Useful for tall narrow hedges. BU, ED, EM, FE, GE, GI, HY, KE, KR, LI, LT, MK, PF, PT, RS, SH, SI, 1, 5, 6, 16, 21, 36, 38, 42.*

'Nigra.' Dark green. Unlike most forms, retains good color in winter. BT, DA, FE, HY, LC, LI, LT, ML, PF, RO, RS, WN, 3, 7, 10, 16, 19, 20, 21, 28, 36, 38, 41.

'Techny.' Very hardy, compact, dark green. BA, LC, MK, PV, RK, RS, SA, SH, WA, 1, 6, 11, 16, 23, 25, 31, 38.

'Wareana.' Pyramidal, dense. Bright green. Very hardy. BA, DA, DE, FE, LA, LI, MK, RS, SH, WN, 1, 3, 32.

Thuja orientalis (6)

ORIENTAL ARBOR-VITAE, BIOTA

Tree to 25 ft. or more, often shrubby. Fresh green foliage in vertical planes. GE, SI, 25, 36. *Selected Form*: 'Baker.' For mild dry climates. BT, LC, 23, 30, 43, 44, 46.

Thuja plicata (6-5)

GIANT ARBOR-VITAE

Fast-growing tree with shiny bright green scale-like leaves. Massive at maturity, and often multi-stemmed. RI, SI, WN, 21. *Selected Form*: 'Atrovirens.' 9, 22.

Thuja standishii (5)

JAPANESE ARBOR-VITAE

Small to medium-sized tree. Often multi-stemmed. Spreading branches. AL, BR, 22.

Hiba Arbor-vitae

Thujopsis dolabrata (6)

Small to medium-sized Japanese tree, sometimes shrubby. Similar to arbor-vitae, but with broader, very flattened branchlets and larger, shiny leaves, silvery beneath. AL, BR, KI, RF, SP, 33.

Japanese Torreya

Torreya nucifera (5)

Usually just a small tree in America. Leaves yew-like, sharply pointed. BR, SP.

Hemlock

Tsuga canadensis (4-3B)

COMMON HEMLOCK

Graceful shade-tolerant tree to 50 ft. or more. Attractive short needles. May be used for dense clipped hedges. This is not a tree for windy sites. ED, GI, ILY, KE, LI, LT, ML, MU, NE, PF, RI, RK, RO, SH, SI, VI, 1, 3, 6, 7, 15, 16, 21, 28, 35, 36, 42.*

Selected Forms:

'*Atrovirens*.' Dark green. KI, ML, 38.

'*Pendula*' ('*Sargentii*'). SARGENT WEeping HEMLOCK. Eventually to 10 ft. or more, three times as wide. One of the finest weeping trees. AL, CB, FO, KI, MD, ML, PA, PF, PK, RF, SP, VI, WA, WF, WN, 8, 15, 17, 23, 28, 33, 35, 38, 40.

Tsuga caroliniana (4)

CAROLINA HEMLOCK

Slower-growing in youth than common hemlock, but often more dense at maturity. It will grow eventually to about 50 ft. EA, GA, LA, LT, ML, MU, PF, RO, WN, 7, 15, 23, 33.

Tsuga diversifolia (5)

JAPANESE HEMLOCK

Usually only a small tree in America. Spreading branches. Often multi-stemmed. BR, CB, DA, MD, RF, SP.

Tsuga heterophylla (5)

WESTERN HEMLOCK

The tallest and perhaps most attractive hemlock, but it requires a humid atmosphere. Not for the Northeast. RF, RI, SI.

Tsuga mertensiana (6)

MOUNTAIN HEMLOCK

Distinctive hemlock native to higher elevations from Alaska to California. Slender, pendant branches and radially spreading needles. Although it may grow to 90 ft. or more in the Northwest, it is only a slow-growing shrub in the Northeast. BR, RF, SI, SP, WI, 33, 42.

Tsuga sieboldii (5)

SIEBOLD HEMLOCK

Similar to *T. diversifolia*. Yellowish-brown, glabrous branchlets (reddish-brown hairy branchlets in *T. diversifolia*). BR, DA, ML, RF, RO, SP.



Roche

Two examples of the American holly (*Ilex opaca*). This species has evergreen foliage.

FLOWERING SHRUBS

Broadleaf-Evergreen and Deciduous

Note: The shrubs in this section are deciduous unless otherwise described.

Bottle-brush Buckeye

Aesculus parviflora (4)

Suckering shrub to 6-8 ft., two or three times as broad as tall. Conspicuous pyramidal clusters of white flowers in early summer when few other shrubs are in bloom. Shade-tolerant, but best flower development occurs in full sun. BR, LI, SH, WN, 28.

For other Aesculus see page 19.

Butterfly-bush

Buddleia alternifolia (5-4B)

FOUNTAIN BUTTERFLY-BUSH

Spreading shrub to 8-10 ft. Long spikes of purplish-lilac flowers in early June. Conspicuous in bloom, but requires periodic pruning to alter a poor growth habit. Prune after flowering. BR, LE, SH, VI, WG, WN, 22, 44.

Buddleia davidii (5-4B)

ORANGE-EYE BUTTERFLY-BUSH

Coarse lanky shrub to 8 ft. or more. Valued only for its prolific foot-long flower spikes, ranging in color from white to red and purple, produced in summer when few other shrubs are in bloom. In the North it is best cut back nearly to the ground in late winter. Wood more-or-less hardy on Long Island. *Selected Forms:*

'Charming.' Pink flowers. BU, FE, HA, MA, NE, RP, SR, WB, ZI, 6, 20, 31, 32, 41, 44.

'Dubonnet.' Flowers deep purple. BU, KS, MA, ML, RO, ST, 32, 41, 44.

'Empire Blue.' Deep blue. CO, EM, FE, HA, IN, KS, ML, PV, WG, ZI, 31, 44.

'Fascinating.' Flowers soft Cattleya-pink. CO, IN, SH, WG.

'Ile de France.' Lilac-purple. BU, CO, MA, RO, ST, WB, 6, 31, 32, 41.

'Peace.' White. FE, SR, WE, 31.

'Royal Red.' Reddish-purple. CO, EM, FE, IN, KS, ML, PV, SH, SR, 31, 44.

Carolina Allspice

Calycanthus floridus (5-4B)

Dense mound to 5 ft. or more. Highly

scented, dark reddish-brown flowers in early May. Much of the material in the trade may be a related species or hybrid having little scent, except in the foliage. Best to purchase locally at time of flowering so that fragrance may be verified.

Camellia

Camellia japonica and forms (7)

COMMON CAMELLIA

Handsome evergreen shrub to 25 ft. or more, much lower toward its northern limit of hardiness. Beautiful white, pink, rose, or red flowers, single or double. Winter to spring flowering. An important mild-climate shrub, but hardiness varies, and plants can be grown in protected sites as far north as Long Island. Little difference in hardiness between this and the following species has been observed at the Brooklyn Botanic Garden. Many, many named forms. BH, CB, ED, GE, NE, NU,



Marjorie J. Dietz

Button-bush, which grows wild in many wetlands, is seldom seen in gardens despite its attractive summer flowers.

PT, TH, 23, 30, 42, 43, 44.

Camellia sasanqua and forms (7)

SASANQUA CAMELLIA

Similar to the preceding, but with smaller evergreen leaves. Autumn-flowering. BH, CB, NU, PT, 12, 14, 27, 20, 23, 30, 43, 44.

Button-bush

Cephalanthus occidentalis (4)

Eventually a tall shrub with coarse foliage. Creamy-white ball-shaped clusters of flowers in mid-summer. Suited mainly for wet sites. DU, LC.

Flowering Quince

Chaenomeles speciosa (lagenaria) and related hybrids (4)

Shrubs 3-6 ft. with showy flowers ranging in color from red to pink and white (and orange in hybrid form). Flowers over a fairly long period in late April and early May. There are many named forms, and it is perhaps best to choose flower color at a local nursery or garden center. Available from most mail-order firms. Wider selection than most: AH, FO, WG, 4, 25, 31.

Wintersweet

Chimonanthus (Meratia) praecox (7)

WINTERSWEET

Shrub to 6-8 ft. with intensely fragrant yellowish flowers in late winter. Of borderline hardiness in New York City. PR, 4, 17, 22.

Mexican-orange

Choisya ternata (7-6B)

Open-growing shrub to 7-8 ft. with 3-in.-long aromatic leaves. Fragrant white flowers in late spring. ED, PT, 17, 23, 42.

Harlequin Glory-bower

Clerodendron trichotomum (6)

Vigorous coarse-leaved shrub to about 6 ft. in the North, attaining small-tree dimensions in the South. Valued for its fragrant white flowers in August and subsequent blue berries. The berry is attractive in the foreground of a persistent red calyx. BR, 22.

Sweet Pepper-bush

Clethra alnifolia (4-3B)

Lanky shrub to 7-8 ft. with upright spikes of strongly fragrant white flowers in summer. Decorative seed pods. Good for somewhat moist soils. Shade-tolerant.

GA, GD, LA, ML, PF, PW, RO, SH, SQ, VI, 3, 6, 9, 20, 21, 28, 35, 41. *Named Form: 'Rosea.'* Flower buds pink. Flowers usually changing to white. BR, GD, KE, KR, LA, ML, PF, RO, WG, WN, 3, 5, 6, 21, 28, 35, 36.

Winter-hazel

Corylopsis pauciflora (6)

Compact shrub to about 4 ft. Handsome light green leaves, prominently veined. Drooping yellow flower clusters in April. The most refined winter-hazel. Choice. 17, 22, 36.

Corylopsis sinensis (6-5B)

CHINESE WINTER-HAZEL

Arching shrub to 7 ft. or more. Nodding spikes of pale yellow flowers about the same time forsythia is in bloom. Fragrant. Leaves bluish-green. Winter buds prominent. While little known, this shrub has performed well in spot plantings at Brooklyn Botanic Garden for many years. DA.

Corylopsis spicata (5-4B)

Arching shrub to 6 ft. or more. Fragrant, bright yellow flowers in early April. BR.

Cotoneaster

Cotoneaster multiflora and var. calocarpa (4)

Graceful shrub to 8 ft. with arching branches and light red or pink berries. The white flowers are only $\frac{1}{2}$ in. across but freely produced. BA, LC, LI, MK, WN, 31.

For other Cotoneaster see pages 56, 66.

Broom

Cytisus 'Hollandia' (5)

To 6 ft. Purple-red flowers in May. OL, RO, RI, SI, 23, 33, 35, 42.

Cytisus praecox (multiflorus \times purgans) (5)

WARMINSTER BROOM

Shrub to 4 ft. or more. Sulfur-yellow pea-like flowers along arched, slender green stems. Early May. This and other brooms need well-drained soil and perform well in predominantly sandy soil. CB, ED, LI, LT, OL, PF, RO, SH, SI, VI, WF, WN, 17, 23, 28, 33, 35, 36, 42.

Cytisus scoparius (5-4B)

SCOTCH BROOM

Shrub to 6 ft. with fairly large, bright yellow flowers a bit later than *C. praecox*. EA, GE, PF, SI, VI, 11, 35.

For other Cytisus: CB, KI, 17, 42.

Dwarf Cytisus: See page 67.

Deutzia

Deutzia gracilis (5-4B)

SLENDER DEUTZIA

Mound-like shrub to 3-4 ft. Upright racemes of white flowers in mid-May. CO, FE, GI, KE, NE, PF, RO, ST, WB, 1, 3, 5, 6, 9, 10, 19, 21, 28, 31, 32, 41, 44.

Deutzia lemoinei (parviflora × gracilis) (4)

To 6 ft. Many small white flowers in mid-May. FA, FO, RO, 1, 6, 9, 28, 31, 41.

Deutzia rosea (gracilis × purpurascens) (5-4B)

Compact shrub to 4-5 ft. with bell-shaped flowers, pink outside. Mid-May. BU, RO, 9, 31, 41.

Deutzia scabra 'Pride of Rochester' (4)

Erect shrub to 7-8 ft; 4½-in.-long spikes of double white flowers a bit later than most deutzias. Flowers with a slight tinge of pink. ED, EM, GE, MA, PF, RO, TE, WB, 9, 21, 31.

Red-vein Enkianthus

Enkianthus campanulatus (4)

Tall upright shrub with refined foliage. Dainty yellow bell-shaped flowers with red veins. Early May. Leaves turn brilliant scarlet or yellow in autumn. Acid soil. CB, DA, FO, HY, LA, LT, ML, PF, RO, VI, WA, WN, 1, 6, 9, 10, 17, 21, 28, 35, 41.

Pearl-bush

Exochorda giraldii 'Wilsonii' (5)

Large upright shrub with attractive racemes of white flowers in late April. Interesting, but not showy, ridged woody seed capsules. LI, VI, 22.

Exochorda macrantha 'The Bride' (racemosa × korolkowii) (5-4B)

Mounded shrub to about 4 ft. Conspicuous 2-in.-wide white flowers in late April. Handsome. CO, WG.

Exochorda racemosa (grandiflora) (4)

Slender spreading shrub to about 8 ft. tall. Hardier than the preceding two, but with slightly smaller flowers. EA, SH, 21, 28, 36.

Forsythia

Forsythia intermedia (suspensa × viridis-sima) (5)

Upright shrub to 7-8 ft. with long, spreading branches. Showy yellow flowers in early April. *Selected Forms*: 'Beatrix Farrand.' Vivid yellow flowers 2-in. wide. AH, CO, FA, GI, KE, KS, RK,

SH, WB, WG, WN, 1, 3, 21, 28, 31, 32, 36, 38, 41.

'Karl Sax.' Similar to the preceding but apparently hardier in bud. GU, IN, RK, RS, SII, ST, WN, 3, 5, 10, 16, 17, 36, 44.

'Lynwood' ('Lynwood Gold'). Golden yellow. AH, CO, EM, FE, GI, KE, KR, MB, PF, RO, SH, ZI, 3, 5, 10, 19, 21, 31, 32, 41, 44.

'Spectabilis.' Deep yellow. CO, HY, LA, LI, LT, PF, RO, SH, ST, WN, 3, 5, 6, 11, 21, 28, 31, 41.

'Spring Glory.' Pale yellow. CO, EM, MB, MU, RO, SH, SR, WB, WG, ZI, 1, 5, 6, 10, 21, 31, 32, 41, 44.

Forsythia ovata (4)

EARLY FORSYTHIA

Spreading shrub to about 4 ft. tall. Pale yellow flowers about a week before other forsythia. Not as showy as *intermedia* forms, but hardier. BA, ED, MK, 31. *Selected Form*: 'Tetragold.' Large bright yellow flowers. Slightly less vigorous than others of its kind. KE, SH.

Forsythia suspensa 'Fortunei' (4)

Robust shrub to 6-7 ft. with long erect, finally spreading stems. Flowers bright yellow. AH, ED, HY, MK, SI.

Forsythia suspensa 'Sieboldii' (4)

SIEBOLD WEEPING FORSYTHIA

Slender, trailing stems characterize this form. Most effective when allowed to droop over a wall. Much of what is sold simply as *F. suspensa* is likely this form. VI, WB, WN, 31.

For other forsythia see page 69.

Fothergilla

Fothergilla major (5-4B)

Slow-growing upright shrub to 6-7 ft. White flower spikes in early May resemble small bottle brushes. Foliage, which often turns fine scarlet in autumn, is similar to witch-hazel but more refined. Choice. BR, LT, PF, WN, 28, 36.

Fothergilla monticola (5-4B)

Similar to the preceding, but with broader habit and slightly larger flower spikes. Another species, *F. gardenii*, growing to 3 ft., should be sought out. BR, KI, LI, SH.

Salt-bush

Halimodendron halodendron (2)

Spiny shrub to 4-5 ft. Small gray leaflets. Fragrant purple pea-like flowers in late May. Suited to limestone soil or coastal conditions. BR, 36.

Witch-hazel

Hamamelis intermedia 'Arnold Promise' *mollis* × *japonica*) (4)

Large shrub, broader than tall at maturity, with numerous yellow flowers in late winter. CB, SH, WN, 28.

Hamamelis mollis (5-4B)

CHINESE WITCH-HAZEL

Tall open-growing shrub valued in moderate climates for its spidery golden-yellow flowers in mid-winter. In cold areas it flowers in early spring. In New York City it usually starts to bloom in late January, the flowers continuing into March. BR, CB, ED, FO, KI, RO, SH, WN, 17, 20, 21, 22, 28, 36, 38. *Selected Form*: 'Brevipetala.' Flowers showier than in the species. BR, GI, WN, 36.

Hamamelis vernalis (5)

SPRING WITCH-HAZEL

Dense shrub to 5 ft. or more. Small yellow flowers appear from December to April, depending on climate. In New York City it usually flowers in a mild January. BA, BR, HE, LN, LT, PF, RO, WG, ZI, 5, 28, 36.

Hamamelis virginiana (4-3B)

COMMON WITCH-HAZEL

Tall shrub with spidery yellow flowers in autumn. More conspicuous than *H. vernalis* but less showy than *H. mollis*. BA, DU, FO, GA, GI, HE, ML, PF, RO, SN, 5, 11, 21, 28, 31, 36.

Rose-of-Sharon

Hibiscus syriacus (5)

Stiffly branched tall shrub or small tree. Valued mainly for its mallow-like flowers in summer. Late to leaf out. Try to buy young specimens in spring. Unusually tolerant of urban conditions. Because of the varied flower color, it is wise to purchase named forms. The following have single flowers 3-3½ in. across:

'Bluebird.' Flowers blue, with a slight lavender tinge. BU, CB, FE, HA, IN, KE, LI, ML, RO, SH, ST, VI, WG, 5, 28, 44.

'Hamabo.' Peppermint. HA, KR, LI, ML, NE, WG, WN, 44.

'Red Heart.' White, with red center. BU, IN, ML, SH, WG, WN, 44.

'William R. Smith.' Completely white. HA, LI, ML, RO, WG, WN, 9.

'Woodbridge.' Purplish-red. HA, LI, ML, RO, WG, 44.

The somewhat less attractive double-flowering forms may be obtained from most nurseries.

Hydrangea

Hydrangea arborescens 'Grandiflora' (4)

HILLS-OF-SNOW

Rounded bush to 3-4 ft. Slightly flattened snowballs of white flowers, beginning in July. CO, EM, FA, FE, GU, MB, NE, SH, ST, WB, 3, 28, 31, 32. *Other Form*: 'Annabelle.' Flower clusters larger. C, CO, ED, GU, KE, MK, RK, RS, SH, 3.

Hydrangea macrophylla (6-5B)

HOUSE HYDRANGEA, HORTENSIA

Rounded shrub to 3-4 ft. in the North, taller in the South. Flowers blue in acid soil, pink in alkaline soil. Rounded flower clusters, 5-10 in. or more in diameter. Summer-blooming. Especially good in coastal areas. Many named forms. KE, LT, PF, RO, SI, VI, WB, ZI, 23, 30, 36, 42, 43, 44. Two hardier forms are of note: 'Domotoi' (4). WG, 41. 'Nikko Blue' (4). CB, EM, IN, KR, MB, ML, NE, SR, SQ, WN, 6, 19, 31. Lacecap forms, with flattened flower clusters, are available from WG.

Hydrangea paniculata ('Praecox,' 'Tardiva') (4-3B)

PANICLE HYDRANGEA

Tall summer-flowering shrub with 8-10 in., pyramidal clusters of partly sterile, partly fertile flowers. FO, LI, SH, WG.

Hydrangea paniculata 'Grandiflora' (4-3B)

PEEGEE HYDRANGEA

Similar to the preceding, but the more conspicuous flower clusters, nearly all sterile, appear several weeks later (August). Showy but coarse. CO, EM, FA, FE, GA, GI, GU, KE, MB, NE, RK, ST, WB, 3, 10, 19, 28, 31, 32, 41.*

Hydrangea quercifolia (6-5B)

OAK-LEAF HYDRANGEA

Broad, suckering shrub to 4-5 ft. tall. Showy white flowers in early summer, not always produced in New England. Foliage coarse but distinctive. Often shows good red autumn color. Shade-tolerant. BR, FO, HA, ML, PF, RO, TE, WB, WG, WN, ZI, 9, 11, 21, 22, 28, 45.

Jasmine

Jasminum floridum (7)

SHOWY JASMINE

Half-evergreen shrub from China to 4-ft. Many small yellow flowers in terminal cymes. Summer-flowering. GE, HA, 11, 44.

Jasminum nudiflorum (7-6B)

WINTER JASMINE

Dense shrub to 5 ft. or more. Twigs green.

Small yellow forsythia-like flowers in late winter. Flowering is often sparse in the North. More reliable in the mid-Atlantic states than in New York City. DA, EA, ED, GE, HA, ML, PF, RK, WB, 1, 11, 20, 22, 23, 28, 41.

Mountain-laurel

Kalmia latifolia (4)

Dense evergreen shrub growing rather slowly to 12 or more ft. May be kept to smaller height by selective pruning, or may even be trained as a small tree. The small white or pink-tinged flowers that appear in late May or June are attractive from near or far. Shade-tolerant. Acid soil. Splendid. BL, CB, EM, HY, LI, LT, PF, PR, RO, SI, VI, WB, WN, ZI, 1, 7, 9, 19, 21, 28, 38, 40, 42.

Kerria

Kerria japonica (4)

SINGLE-FLOWERED KERRIA

Shrub to 4 ft. with 2-in.-wide bright yellow flowers in early May. Flowers single. Green stems provide winter interest. Shade-tolerant. PF, SH, WG, WN, 22, 42. *Selected Form:* 'Picta.' Variegated white foliage. Dense mound. SH.

Kerria japonica 'Pleniflora' (4)

DOUBLE-FLOWERED KERRIA

Dense shrub to 6-8 ft. with conspicuous globe-shaped flower clusters in early May. Occasional flowers in summer. Thicket-forming. CB, EM, KE, KR, ML, PF, RK, RO, SH, SI, SQ, TE, WB, WE, WG, ZI, 10.

Beauty-bush

Kolkwitzia amabilis (4)

Vigorous, tall-growing, vase-shaped shrub. Showy pink flowers a bit later than most other spring-blooming shrubs. Flower color variable. BU, FE, GU, KE, MB, NE, PF, RO, SH, SR, WB, WG, ZI, 1, 3, 6, 15, 19, 21, 28, 31, 42. *Named Form:* 'Ruys Pink'. IN.

Crape-myrtle

Lagerstroemia indica (7-6B)

Shrub to 10 ft. or more, or a small tree with attractive mottled bark. Beautiful in flower in the summer. Color ranges from pink to red or white, depending on the particular shrub. May be treated as a die-back in warmer parts of the North, but it is most spectacular in the South. Many named forms. BH, BU, DA, EM,

GE, HA, IN, MB, TE, WB, ZI, 11, 14, 19, 20, 30, 31, 36, 43, 44. *Selected Form:* 'William Toovey.' Deep rose. EA, 14, 20, 36. Dwarf crape-myrtle forms available from HA, ML, NE, PR, TE, 44. Reportedly hardier dwarf forms available wholesale from Otto Spring Nursery, 1220 East Sixth Street, Okmulgee, Oklahoma 74447.

Bush-clover

Lespedeza thunbergii (*Desmodium pendulifolium*) (5)

Shrub to 4-5 ft. with gracefully arching stems. Conspicuous rose-purple, pea-like flowers in very late summer. Useful for dry soils. BR, DU, NE, VI.

Honeysuckle

Lonicera fragrantissima (6-5B)

WINTER HONEYSUCKLE

Vase-shaped shrub to 7 ft. or more. Twiggy. Highly scented small flowers in early spring. Leaves retained until late autumn. EA, GE, HA, KR, LI, LT, ML, RK, ST, WB, 9, 11, 20, 21, 28, 31, 41.

Lonicera morrowii (3)

Dense shrub to 5-6 ft., usually broader than tall. Yellowish-white flowers in mid-May. Dark red berries in early summer. GE, LC, MK, SH, WB, WN, 3, 21, 28, 31, 32.

Lonicera tatarica (3)

TATARIAN HONEYSUCKLE

Vigorous shrub to 8 ft. or more. Handsome flowers in mid-May, followed by red berries in early summer. Like most honeysuckles, it is tolerant of poor soil. FE, GU, KE, ML, RK. *Selected Forms:* 'Alba.' White flowers. GU, MA, RO, RS, 28, 31.

'Arnold Red.' Darkest red flowers of any honeysuckle. CO, FE, KE, MB, SH, 6, 11, 36, 41.

'Bouquet,' a selection with white flowers and profuse orange berries. IN.

'Lutea.' Pink flowers and showy orange-yellow berries. WN.

'Rosea.' Pink flowers. CO, EM, LT, MA, PW, RO, RS, WB, WE, 5, 6, 11, 20, 28, 31.

'Zabelii.' Dark red flowers. Excellent. BU, CO, EM, GI, KE, KS, NE, PV, RS, SQ, WB, WE, 3, 5, 9, 10, 16, 28, 31, 32, 41.

For other *Lonicera* see page 58 and 71.

Magnolia

Magnolia liliflora 'Nigra' (*soulangiana nigra*) (6-5B)

LILY-FLOWERED MAGNOLIA

Spreading shrub to 8 ft. or more. Flowers dark purple outside, light purple inside. Flowers mid- or late May after the common spring-blooming magnolias. DO, ED, PT, 30, 44.

Magnolia stellata (5-4B)

STAR MAGNOLIA

Shrub or small tree to 10 ft. or more. Showy white flowers in early spring. In the North, it is best planted in an unprotected spot so that the flowers, which are often damaged by spring frosts, will be delayed a few days. Of interest every season of year. BR, BU, DO, ED, GE, HA, LI, LN, ML, PT, VI, WN, 1, 9, 17, 19, 21, 25, 28, 30, 35, 38, 40, 41, 42, 44. *Selected Forms:*

'Royal Star.' Flowers larger, reportedly hardier in bud. DO, ML, PR, SR, WN, 38.

'Rubra.' Pink flowers. (Another form, 'Rosea,' is usually pink only in bud). DO, GI, GO.

'Waterlily.' Flowers slightly larger than in the species. Bushy, upright. LI, 36, 38, 42. *For other magnolias see page 23.*

Mahonia

See page 59.

Sargent Crab-apple

Malus sargentii (4)

Dense shrub to about 6 ft., often broader than tall. Attractive white flowers in early May. Very small red fruit sometimes retained into winter. CB, DA, HE, HY, LC, LI, LT, OL, RO, SH, SI, VI, WN, 5, 15, 17, 21, 28, 36, 42.

Mock-orange

Philadelphus coronarius (4)

COMMON MOCK-ORANGE

Shrub to 7-8 ft. Intensely fragrant white flowers, 1-1½ in. across, late May. Much of the material in the trade may be a scentless larger-flowered hybrid. Advisable to purchase locally at time of flowering so that fragrance may be verified.

Philadelphus lewisii 'Waterton' (4)

Compact, to 4 ft. Odorless white flowers in late May. AE, DE, ED.

Philadelphus 'Minnesota Snowflake' (4-3B)

To 8 ft. Fragrant white flowers, 2 in. across. CA, CB, FA, KE, KS, MK, NE, RK, SH, SI, WB, 1, 3, 9, 10, 32, 41, 44.

Philadelphus 'Silver Showers' (4?)

Dense, to 4 ft. or more. Flowers single.

CB, FE, GI, SH, WG, WN, 5, 6, 31.

Philadelphus virginialis 'Virginal' (4)

VIRGINAL MOCK-ORANGE

Leggy shrub to 7 ft. or more. Highly fragrant double-white flowers, 2 in. across. BU, CB, CO, EM, FE, GU, KE, MK, NE, RO, SH, ST, 3, 5, 6, 9, 16, 21, 28, 41, 44.*

Other forms from BA, FO, LI, MK, SH, WG, 5, 31.

Pieris

Pieris japonica (6-5B)

JAPANESE PIERIS (ANDROMEDA)

Refined evergreen shrub to about 7 ft. Drooping clusters of white bell-shaped flowers over a long period in April. Of year-round interest. Commonly and misleadingly called "andromeda." Member of heath family. BU, CB, GI, HY, LI, LT, ML, MU, PF, PT, RO, SI, SR, VI, WB, 1, 9, 15, 21, 23, 28, 33, 35, 36, 38, 40, 41, 42.* *Selected Form:* 'White Cascade.' 38.

Pieris taiwanensis (7-6B)

TAIWAN PIERIS

Evergreen shrub to about 5 ft. Long drooping clusters of white flowers in early spring. DA, WN, 46, 45.

For other Pieris see page 72.

Cherry, Flowering Almond

Prunus besseyi (3)

WESTERN SAND CHERRY

Shrub to 5-6 ft. with attractive small white flowers in early May. More-or-less edible purplish-black cherries in early summer. Foliage lustrous. DU, SH, WN, 15. *Selected Form:* 'Hansen.' Abundant flowers and fruit. EM, MK, SR, TE.

Prunus tomentosa (3)

NANKING or MANCHU CHERRY

Shrub to 6-7 ft. with showy white flowers in mid-April, followed by conspicuous red fruit. Attractive bark and foliage. AE, BA, DU, EM, FA, FE, MK, MU, RS, SH, SR, TE, WN, 15, 21, 32, 36.

Prunus triloba (triloba 'Multiplex') (4-3B)

FLOWERING ALMOND

Spreading shrub to 8 ft. or more. Showy double pink flowers in mid-April. AE, BU, CO, FA, GU, KE, KR, MA, ML, RS, SH, TE, VI, WG, 16, 21, 32.

For other Prunus see pages 26, 61.

Pomegranate

Punica granatum (7)

Deciduous shrub to 8-10 ft. with scarlet

flowers in May, June. Double-flowered form is the most common. EA, GE, HA, PT, 4, 30.

Azalea

Rhododendron arborescens (4)

SWEET AZALEA

Shrub to 6 ft. or more. Fragrant white flowers in early June. Azaleas are part of the large rhododendron genus, but for clarity most nurseries list them separately. BL, GA, HY, LA, LT, ML, OL, PW, RO, WN, 7, 21, 36.

Rhododendron calendulaceum (5-4B)

FLAME AZALEA

Shrub to 6-8 ft. with showy and long-lasting orange flowers in late May. Flowers sometimes yellow or scarlet. BL, DA, GA, GI, HY, ID, LA, LT, ML, OL, RO, WB, WN, 3, 7, 11, 21, 28, 38.

Rhododendron canadense (3-2B)

RHODORA

Azalea to 3 ft. with rose-purple flowers in late April. Best grown under cool, moist conditions. For the natural garden. GA, PW, SW, WN.

Exbury Azaleas (6-5)

Deciduous hybrids of complex parentage. Large flowers, ranging in color from orange to pink, red and creamy white. Eventual height 8 ft. or more. Best to purchase named forms. *Named forms* from: BL, CM, GI, IS, MD, OL, SS, WF, WG, WN, 17, 21, 23, 38.

Rhododendron gandavense (4)

GHEENT AZALEA

Mixed hybrid, deciduous azaleas to 5 ft. or more. Flowers white to pink and orange. Some double-flowered. Many named forms. *Named forms* from: GI, IS, WN, 3, 22.

Glenn Dale Azaleas (based on *R. obtusum*) (6-5B)

Semi-evergreen shrubs to 4 ft. or more. Flowers range from red to pink and white and lavender. Many outstanding named forms. HA, OL, WB, 10, 23, 36, 42. The National Arboretum, Washington, D. C. 20250 has a mimeographed sheet of other sources for Glenn Dale Azaleas.

Rhododendron kosterianum (molle × japonicum) (5)

MOLLIS HYBRID AZALEAS

Deciduous shrubs to about 5 ft. Showy yellow to red flowers in mid- to late May. Many named forms. BA, CO, DA, HY, LI, LT, 22, 28.

Rhododendron molle (5)

CHINESE AZALEA

Shrub to 5-6 ft. with yellow flowers in mid-May. Many plants listed as such are probably hybrids with *R. japonicum*. EA, HE, IS, LA, LT, MA, OL, RO, VI, WN, 7, 11, 33, 35.

Rhododendron mucronatum (ledifolium album) (6-5B)

SNOW AZALEA

Excellent dense evergreen or nearly evergreen shrub to 4-5 ft. Fragrant white flowers in late April. Not always of reliable hardiness in New England. EA, GE, KI, 3, 21, 33, 42.

Rhododendron nudiflorum (4-3B)

PINKTERBLOOM AZALEA

Shrub to 5-6 ft. with light pink flowers in mid-May. Deciduous. GA, HY, LT, ML, PW, RO, 1, 7, 21.

Rhododendron obtusum japonicum hybrids (7-6)

KURUME AZALEAS

Dense evergreen shrubs to 3 ft. Single or double flowers ranging in color from white to pink and red. Considerable variability in hardiness, some being hardy as far north as Long Island. Many named forms. DA, HA, NU, OL, TE, TH, WB, 10, 19, 20, 21, 36, 42.

Rhododendron obtusum kaempferi and hybrids (5-4B)

TORCH AZALEA

Dense deciduous shrub to 6 ft. or more. Flowers from red to pink and orange. Free-flowering. DA, LA, LI, LT, VI, WN, 3, 10, 21, 42, 44, 45.

Rhododendron roseum (4-3B)

ROSE-SHELL AZALEA

Deciduous, to 6 ft. or more. Fragrant bright pink flowers in mid-May. BL, LA, OL, RO, WN.

Rhododendron schlippenbachii (4)

ROYAL AZALEA

Ultimately a tall shrub (to 15 ft.). Fragrant large flowers, usually a good pink, in full bloom usually by early May. Good autumn color. BL, CM, DA, ID, LI, LT, ML, OL, RO, SH, VI, WG, WN, 1, 3, 22, 33, 36, 38.

Rhododendron vaseyi (4)

PINK-SHELL AZALEA

Shrub to 5-6 ft. with light rose flowers in early May. Usually good autumn color. BL, DA, EA, GA, HY, LA, LT, OL, PW, RO, VI, WN, 1, 3, 7, 21, 35, 38. *Selected Form: 'White Find.'* Flowers white. BL, LA, OL.



Left: Scented white flowers of the star magnolia are especially welcome after a long winter, but velvety winter buds, irregular branching and light gray bark make the wait a pleasant one. Below: Flowers of *Rhododendron vaseyi* are usually light pink, but 'White Find,' a cultivated variety of this native azalea, is equally suited to the semi-naturalized garden.

Helen S. Witty

Marjorie J. Dietz





Helen S. Witty

Left. Abelia-leaf (*Abelio-
phyllum distichum*), one of
the first shrubs to bloom
in spring, is a forsythia
relative with white flow-
ers. Nurserymen, in fact,
sometimes call this slow-
growing Korean shrub
"white-forsythia." Below:
Yellow brooms (*Cytisus*)
lighten an otherwise sur-
rounding somber wood-
land when planted on a
gentle sun-touched slope.

Marjorie J. Dietz



Rhododendron viscosum (3)

SWAMP AZALEA

Shrub to 6-8 ft. with intensely fragrant, white or whitish-pink flowers in early summer. Good autumn color. Tolerant of wet sites. BL, GA, LA, OL, PW, RO, WN, 8, 21.

Rhododendron yedoense poukhanense (4)

KOREAN AZALEA

Dense shrub to 3-4 ft. with fragrant petunia-purple flowers in early May. Deciduous or semi-evergreen. Often listed as *Azalea poukhanensis*. AH, CM, HY, LA, LI, LT, ML, RO, WN, 1, 3, 9, 11, 15, 28, 33, 36, 38.

For other azaleas see end of rhododendron listing; also HA, IS, NU. For dwarf azaleas and rhododendrons see page 73.

Rhododendron

Rhododendron carolinianum (5-4B)

CAROLINA RHODODENDRON

Compact shrub to 4-5 ft. with handsome short evergreen leaves. Light rosy-purple to pink flowers in early May. AH, BL, CB, DA, GA, GI, HY, ID, LA, LT, OL, VI, 1, 3, 6, 7, 19, 21, 35, 36, 38. Selected Form: 'Album.' BL, CB, GA, GD, HY, LA, 35, 38.

Rhododendron catawbiense (4)

CATAWBA RHODODENDRON

Shrub to 5 ft. or more. 5-in.-long evergreen leaves. Lilac-purple flowers in late May. GA, GD, LA, LT, PF, PW, WB, WN, 3, 6, 7, 19, 21. There are many named *catawbiense* hybrids with flowers ranging from red and purple to white. GI, HY, LI, RO, 1, 19, 21, 28, 38.

Rhododendron fortunei (6)

FORTUNE RHODODENDRON

Shrub to 8 ft. or more with long evergreen leaves. Rosy-lilac or bluish-pink flowers in mid-May. CM, ID.

Rhododendron laetevirens (carolinianum × ferrugineum) (5-4B)

WILSON RHODODENDRON

Compact evergreen shrub to 4-5 ft., grown more for its pieris-like leaves than its small purplish-pink flowers in late May. Usually listed as *R. wilsonii*. CB, DA, HY, LT, MF, OL, PF, PK, 3, 6, 7, 21, 35, 36.

Rhododendron maximum (4-3B)

ROSE BAY RHODODENDRON

Tall evergreen shrub, almost tree-like to 20 ft. or more under good growing conditions. Flowers rose to purple-pink in mid-June, often obscured by the long

leaves. Useful because of its exceptional hardiness. GA, HY, LA, LI, LT, PW, VI, WB, WN, 7, 19, 20, 21, 36, 38.

Rhododendron mucronulatum (4-3B)

KOREAN RHODODENDRON

Deciduous shrub to 5-6 ft. with rose-purple flowers in late March or early April. Repeat flowering in mild autumns. Buds sometimes suffer frost injury in parts of New England. Azalea-like in appearance, but a true rhododendron. DA, FO, GI, LA, LI, LT, MD, OL, RA, RO, SH, VI, WG, 1, 3, 9, 17, 21, 22, 35, 36, 38. Pink-flowering forms, including 'Cornell Pink,' available from BL, VI, WN, 3.

Rhododendron smirnowii (4)

SMIRNOW RHODODENDRON

Evergreen shrub to 6 ft. or more. Numerous white to rosy-red flowers in mid-May. Leaves woolly-white beneath. KI, OL, RA, WN.

Named hybrid rhododendrons available from many firms, including BL, CB, CM, GI, ID, LA, MF, OL, RA, SE, WN, 33, 37, 42. Some exceptionally good ones include 'Boule de Neige' (white flowers); 'Ben Moseley' (pink); 'Caroline' (fragrant pink flowers); 'Champagne' (cream); 'Christmas Cheer' (early white flowers on compact shrub); 'Cunningham's White' (white); 'Duke of York' (pale lilac); 'Janet Blair' (pink); 'Kettledrum' (magenta with yellow markings); 'Lady Armstrong' (magenta with deeper markings); 'Lee's Dark Purple'; 'Pink Twins' (semi-double flowers); 'Pioneer' (early rose-colored flowers); 'Roslyn' (late purple); 'Scintillation' (pink); 'Vulcan' (red); 'Westbury' (pink); 'Wheatley' (pink).

For dwarf rhododendrons see page 73.

Currant

Ribes aureum (2)

GOLDEN CURRANT

Vigorous shrub to about 6 ft. with conspicuous yellow, usually fragrant flowers in late April. Many currants serve as alternate hosts for white pine blister rust and should not be planted where 5-needle pines are prevalent. LI, SH, VA, WE, 22.

Ribes odoratum (4)

CLOVE CURRANT

Similar to golden currant but with more intensely fragrant flowers. In fact, the flowers are among the most highly scented of any shrub hardy in the North. FO.

Ribes sanguineum 'King Edward VII' (5)

Shrub to 4-5 ft. with small dark green leaves. Red flowers in early May. More satisfactory in New York City than most plants from the Northwest, but will occasionally suffer winter injury. WG, WN.

Rose

Rosa harisonii (foetida × spinosissima) (4)

HARISON'S YELLOW ROSE

Shrub to 4-5 ft. with attractive double yellow flowers in late May. Fruits inconspicuous. The rose species that follow are of simple culture and do not need the coddling associated with hybrid teas. The fruits or "rose hips," especially those of *R. multiflora*, are an attraction to wildlife. BA, GU, MK, RS, TI, WG, WN, WY, 32.

Rosa hugonis (5-4B)

FATHER HUGO ROSE

Shrub to 5-6 ft. with single yellow flowers in mid-May. Important because it is usually the first rose to bloom in spring. Fruits dark red. BA, ED, FA, HY, KE, KN, KS, LC, LT, MB, MK, TI, WN, 6.

Rosa moyesii (5)

MOYES ROSE

Vigorous shrub to 7 ft. or more. Deep red single flowers in early June. Conspicuous 2½-in.-long, orange-red fruits in autumn. ED, KN, WY.

Rosa multiflora (5-4B)

MULTIFLORA OR JAPANESE ROSE

Strong-growing shrub to about 8 ft. Numerous small white flowers in early June. Long-lasting small red fruits in autumn. Valuable shrub for wild-life. CO, FE, FO, GE, GU, KR, LI, LT, ML, RK, RO, SH, SS, WN, 21, 31, 39, 47.

Rosa palustris (4)

SWAMP ROSE

To 5 ft., with single Persian-rose flowers in late May or June. Attractive red fruit in autumn. Unusual among roses because of its tolerance of wet sites. 28.

Rosa pomifera (5)

APPLE ROSE

To 5 ft., with single pink flowers in late May or June. Grown mainly for its odd, somewhat pear-shaped, 1½-in.-wide red fruit. KN.

Rosa rugosa (3-2B)

RUGOSA ROSE

Variable shrub to about 5 ft. with attractive wrinkled foliage. Flowers range from

magenta to white, late May. Occasional flowers produced in summer. Showy red fruits from summer to autumn. Good orange fall color. Especially useful along the sea shore. CO, ED, FO, HY, KE, KN, LT, MK, MU, PF, RO, SH, WN, 3, 5, 6, 20, 21, 28, 31, 32, 35, 36. *Selected Form:* 'Alba.' White flowers. FO, KN, LT, PF, RO, WN, 3, 5, 6, 21, 28, 36. *Rugosa* hybrids from: BA, CO, KN, LN, MK, RS, WG, 32.

Rosa spinosissima 'Altaica' (4)

SCOTCH ROSE FORM

Shrub to 4 ft. or more, with 3-in.-wide yellow flowers in late May. AL, KN.

Rosa virginiana (lucida) (3)

VIRGINIA ROSE

Shrub to about 5 ft. with magenta or pink flowers in early June. Single. Shiny leaves turn scarlet or orange in autumn. Red fruits. FO, KN, MK, RO, SN.

For other roses see page 61.

Flowering Raspberry

Rubus odoratus (3)

Thornless shrub to 6-7 ft. with coarse maple-like foliage. Fragrant purplish-rose flowers in early summer. Edible fruit. Shade-tolerant. BR, GA.

Willow

Salix caprea (4)

PUSSY WILLOW (EUROPEAN GOAT WILLOW)

Vigorous shrub to 10 ft. or more. Effective in late winter with its velvety gray catkins upon which bright yellow stamens eventually appear (on staminate plants). Suited for moist soils, but will also grow well under average garden conditions. Prune severely in early spring for a good "crop" of pussy willows the following winter. BA, EM, GI, KE, RK, RS, SH, WE, WN, 28, 32.

Salix discolor (3-2B)

AMERICAN PUSSY WILLOW

Catkins slightly smaller than those of the preceding, but useful in northern areas. BU, ML, RO, SQ, WB, 3, 11, 16, 21, 31.

Salix gracilistyla (5-4)

KOREAN ROSE-GOLD PUSSY WILLOW

Shrub to 6-7 ft. Pinkish catkins and yellow stamens. CB, FO, SI, ZI.

For other willows see page 17 and 61.

Ural False-spirea

Sorbaria sorbifolia (2)

Strong-growing shrub to 6 ft. with showy

white flowers in early summer. Useful on banks. BA, FO, LN, PF, SH, WN.

Spirea

Spiraea arguta (thunbergii \times multiflora) (4)

GARLAND SPIREA

Handsome shrub to 5 ft. with white flower clusters. Resembles *S. vanhouttei* but blooms several weeks earlier. AH, BA, CO, FE, GU, KR, MK, WE, WN, 31, 32. *Selected Form*: 'Compacta.' BA, WN.

Spiraea billiardii (douglasii \times salicifolia) (3)

BILLIARD SPIREA

Upright shrub to 4-5 ft. Tall dense "steeples" of rose-colored flowers in mid-June. AE, BA, CO, EM, 21, 31.

Spiraea macrothyrsa (douglasii \times latifolia) (4)

Similar to the preceding, but with horizontal branches. KE, LE, 5.

Spiraea nipponica (4)

SNOWMOUND SPIREA

Shrub to about 6 ft. with numerous flat clusters of small white flowers in mid-May. Foliage nearly bluish-green. BA, BU, CB, CO, FE, IN, MB, MK, ML, RO, RS, WG, WN, 1, 3, 5, 6, 28, 41, 44.

Spiraea prunifolia (5)

BRIDAL-WREATH SPIREA

Shrub to 6-7 ft. with white button-like flowers in early May. Lustrous foliage turns orange-scarlet in autumn. DA, EA, ED, FA, FO, GI, MB, PF, PW, RO, SI, VI, WB, WN, 14, 21, 28, 30, 31, 41, 44.

Spiraea thunbergii (4)

THUNBERG SPIREA

Slender-branched shrub to about 5 ft. Pure white flowers along the stems in late April. Needs more pruning than most spiraeas because its numerous small twigs die out unexpectedly. GE, GI, HA, HY, NE, PF, RO, RS, ST, VI, WB, WN, 14, 21, 31, 32, 41.

Spiraea trichocarpa (5)

KOREAN SPIREA

Spreading shrub to 6 ft.; 2-in. clusters of white flowers in late May. AE, DE, FO, SH.

Spiraea trilobata (4-3B)

HAWTHORN-LEAF SPIREA

Shrub to 3-4 ft., resembling *S. vanhouttei* but smaller in every part. Mid-May. GD, IN, LC, SH.

Spiraea vanhouttei (cantoniensis \times trilobata) (4)

VANHOUTTE SPIREA

Dense shrub to 5-6 ft. with showy clusters

of pure white flowers along arching branches. Mid-May. Common, with reason. BU, CO, EM, FA, FE, GI, GU, IN, KE, KS, ML, MU, SR, WB, 1, 3, 10, 16, 28, 30, 31, 41, 44.*

For other spiraeas see pages 74-75.

Lilac

Syringa chinensis (rothomagensis) (laciniata \times vulgaris) (4)

CHINESE LILAC

Shrub to about 10 ft. with loose panicles of purple-lilac flowers in mid-May. Leaves smaller than those of *S. vulgaris*. Incorrectly called "Persian lilac" in many catalogs. AH, BA, FA, FE, LI, MB, NE, PF, PV, RS, WN, 20, 28, 31, 32, 44.

Syringa josikaea (2)

HUNGARIAN LILAC

Shrub to 8 ft. or more. Lilac-violet flowers in late May. Leaves shiny green. AH, ML, VA, 15, 44.

Syringa meyeri (5)

Dense shrub to 7-8 ft. with dark purple flowers in late April or early May. Not intensely fragrant. The lustrous foliage is retained in good condition at the Brooklyn Botanic Garden through summer, a time when the effect of air pollution on lilacs is severe. Source: Kingsville Nurseries, Kingsville, Maryland 21087.

Syringa microphylla 'Superba' (5)

DAPHNE LILAC FORM

A cultivar of the daphne lilac with deep pink flowers in early May. Broader than tall at maturity. Eventual height about 6 ft. CB, CO, KI, WE, WF, WG, 5, 41.

Syringa persica (afghanica \times laciniata) (4-3B)

PERSIAN LILAC

Multi-stemmed shrub to 5-6 ft. with small leaves. Pale lilac flowers in mid-May. Often confused with *S. chinensis*. AE, BU, EM, FO, GI, GU, HA, LC, LT, PF, RO, SI, WG, 9, 21, 30, 47. *Selected Form*: 'Alba.' Flowers white. FO.

Syringa prestoniae (reflexa \times villosa) (2)

PRESTON LILAC

A hybrid group of lilacs growing to 8-9 ft., with attractive flowers ranging from pink to purple and white. Late May. Not very fragrant, but among the hardiest of all lilacs. *Selected Form*: 'James MacFarlane.' Flowers pink. AH, CB, KE, RO, RS, SH, SQ, WF, WG, WN, 3, 4, 6, 41, 44. *Other Named Forms*: AE, AH, BA, SH, WN.

Syringa pubescens (5-4B)

Shrub to 5 ft. or more. Whitish-lavender

flowers in late April. One of the most highly scented lilacs. Relatively poor growth habit. DA, WN.

Syringa velutina (palibiniana) (4-3B)

Small-leaved shrub to 6-8 ft. Lilac flowers in 6-8-in. panicles. Early to mid-May. Sometimes called "rock garden lilac" because of its fairly slow growth. AH, AL, BA, CB, HE, KR, ML, RS, VI, WF, WG, WN, 1, 4, 21, 36, 44. *Named Form:* 'Miss Kim.' Flowers light lavender. AH, BA, WG, 3, 36.

Syringa villosa (3-2B?)

LATE LILAC

Dense upright shrub to 7-8 ft. with rosy-lilac or white flowers. Late May. Not very fragrant. AE, AH, DE, GU, LI, MK, PF, PV, PW, RO, SH, WN, 15, 21, 28, 31, 32.

Syringa vulgaris (3)

COMMON LILAC

Shrub to 15 ft. or more. Fragrant flowers in early May. Color range: purple to pink, yellow and white. Flowers single or double. A rugged well-known dooryard shrub, but susceptible to mildew, scale and borers. Best to purchase "own-root" lilacs to avoid privet graft blight. Nearly all lilacs are prone to air pollution injury, especially *S. vulgaris* and its many forms. Better than average selection of named forms, often called "French hybrids," available from: AH, BA, FO, HE, LI, MK, RK, RO, SH, WG, WN, 3, 4, 5, 9, 16, 28, 31, 32, 41.

Tamarisk

Tamarix hispida (4?)

KASHGAR TAMARISK

Shrub to 4 ft. or more, with silvery juniper-like leaves. Dainty racemes of pink flowers in the latter part of summer. Like other tamarisks, it grows well in dry, even sandy soil. Not always easy to establish. Best planted in spring, and pruned severely at planting time. GU, MA, NE, RO, ST, 31.

Tamarix pentandra (4-3B)

FIVE-STAMEN TAMARISK

Tall shrub with light green juniper-like foliage. Tolerant of coastal conditions. Pink flowers in mid-summer. Lankiness may be curtailed by a sharp pruning in early spring. RS, SH, WE. *Selected Forms:* 'Pink Cascade.' Flowers light pink. EA, EM, RO, SH, WG, 31. 'Summer Glow' ('Rubra'). Flowers dark pink. CB, FA, FE, IN, KE, LT, WG, ZI, 31.

Viburnum

Viburnum burkwoodii (carlesii × utile) (5)

BURKWOOD VIBURNUM

Refined shrub, ultimately to 7 ft. or more. Shiny leaves retained late in autumn. Fragrant pinkish-white flowers in early May. ED, EM, ML, PF, RK, WN, ZI, 1, 21, 23, 25, 28, 30, 38, 41, 42, 44.

Viburnum carlecephalum (carlesii × macrocephalum) (5)

Open shrub to 6 ft. or more. Fragrant white flower clusters in mid-May. Despite a mediocre growth habit, it is one of the best viburnums in flower. BA, CO, DA, HE, IN, LI, SH, VI, WE, WG, WN, 4, 21, 25.

Viburnum carlesii (4)

KOREAN SPICE VIBURNUM

Broadly rounded shrub to about 5 ft. Clusters of fragrant, pinkish-white flowers in early May. Berries black, ripening in early summer, but not dependable. Often grafted on other viburnums. Beware of understock. CB, EM, FE, GI, IN, KE, MB, ML, PF, RO, SR, TE, ZI, 1, 3, 6, 9, 15, 21, 28, 38, 41, 42. *Selected Form:* 'Compactum.' CB, FO, HY, LI, RO, WN, 5, 17.

Viburnum farreri (fragrans) (5)

FRAGRANT VIBURNUM

Shrub to 6-7 ft., valued mainly for its scented white flowers in late March. Flower buds pink. The first viburnum to flower in the North. Fruits inconspicuous. FO, RK, SH, 38. *Selected Form:* 'Album.' Buds and flowers white. FO.

Viburnum juddii (carlesii × bitchiuense) (5)

JUDD VIBURNUM

Similar to *V. carlesii*, but with more handsome foliage. Flowers less fragrant. BR, HA, HE, KI, LI, LN, NE, PF, RK, WA, WG, 5, 25.

Viburnum macrocephalum (m. 'Sterile') (6)

CHINESE SNOWBALL

Shrub to 8 ft. or more. Rounded 6-in. heads of sterile white flowers in mid-May. The most showy, if least hardy, of the snowballs. Leaves held late in autumn. BR, 22, 25, 44, 45.

Viburnum opulus 'Roseum' ('Sterile') (3)

EUROPEAN SNOWBALL

Tall loose shrub with showy flowers in mid-May. Because of its susceptibility to plant lice, it should be used only where *V. plicatum* is not hardy. None of the snowball forms bear fruit. CB, CO, FA, FE, GU, KS, MB, RS, SH, WN, 6, 16, 21, 28, 30, 31, 41, 44.

Viburnum plicatum (tomentosum 'Sterile') (4)

JAPANESE SNOWBALL

Shrub to 7-8 ft. with showy rounded heads of sterile white flowers in late May. Saw-toothed oval leaves with prominent veins. The best snowball for the North. CB, ED, GE, GI, KE, KR, ML, NE, RK, RO, SH, SQ, WE, 28, 42.

Viburnum plicatum 'Mariesii' (4)

MARIES DOUBLE-FILE VIBURNUM

Flat flower clusters surrounded by large sterile florets. Horizontal branching, with flower clusters produced along the branches. Free-blooming. One of the finest flowering shrubs, but it needs much room for proper development. Superb when seen from a second-floor window. Red berries. CB, DA, FO, HY, LI, ML, PR, RK, WG, WN, 1, 5, 21, 23, 25, 36, 41, 42.

Viburnum plicatum 'Roseum' ('Pink Beauty') (4)

PINK DOUBLE-FILE VIBURNUM

Similar to the above, but with flowers fading pink over a long period. An attractive, rather slow-growing form found many years ago in the Brooklyn Botanic Garden. Best with age. BA, BR, CB, WN.

Viburnum plicatum 'Rotundifolium' (4)

EARLY JAPANESE SNOWBALL

Flowers two weeks earlier than the Japanese snowball. LC, LI, 5.

Viburnum plicatum tomentosum (V. tomentosum) (4)

DOUBLE-FILE VIBURNUM

Similar to 'Mariesii', but slightly less showy in bloom. Despite its curious nomenclature, this is the species found wild in Japan and China—and the Japanese snowball is a garden form of it. DU, FO, HY, LT, ML, PF, RO, SH, SR, SQ, VI, WB, WG, 1, 3, 5, 9, 10, 21, 28, 31, 38, 41, 42.

Viburnum sieboldii (5-4B)

SIEBOLD VIBURNUM

Tall shrub, sometimes tree-like, with lustrous 6-in.-long leaves. Flat, wide clusters of white flowers in mid-May. Red berries in summer. Distinctive when trained as a small tree. BA, DA, DU, FO, GD, HY, LA, LC, LN, ML, RO, SH, 1, 3, 5, 9, 21, 28, 31, 38, 41.

For other viburnums see pages 62-63.

Vitex

Vitex agnus-castus 'Latifolia' (V. macrophylla) (5)

CHASTE-TREE

Large mounded shrub to about 10 ft. Graceful gray-green leaves. Valued for its



Marjorie J. Dietz

The chaste-tree flowers in late summer.

light violet flower spikes in August. Advisable to treat as a die-back shrub in the northern part of its hardiness range. In New York City it requires some pruning each spring, but need not necessarily be treated as a die-back shrub. One of the last shrubs to leaf out in spring. BU, CB, FO, GE, HA, KE, KR, ML, NE, PF, RO, SR, SQ, WG, ZI, 28, 41. *Other Form:* 'Silver Spire.' Flowers white. CB, HA, RO, WG.

Vitex negundo heterophylla (incisa) (5)

Similar to *V. agnus-castus*, but with notched leaflets. TE.

Weigela

Weigela hybrids (5-4B)

Rather uneven-growing, loosely mounded shrubs to 6-7 ft. Showy trumpet-shaped flowers in late April or early May. Weigelas need more than average pruning to look their best. Prune after flowering. *Selected Forms:*

'Bristol Ruby.' Flowers purplish-red. BA, CO, LT, MK, NE, PW, SH, SR, WG, 31, 41, 44.

'Bristol Snowflake.' Flowers white. AH, FO, IN, WG, 5, 44.

'Vanicek' ('Newport Red'). Purplish-red flowers. Slightly harder than others. (Some catalogs list as "cardinal shrub.") BT, EM, FA, FE, GI, GU, IN, KE, MB, ML, NE, ST, WB, 3, 5, 6, 9, 16, 21, 28, 31, 32, 41. For other weigelas see page 63.

SHRUBS PLANTED FOR FOLIAGE AND FRUITS

Deciduous unless otherwise noted

Acanthopanax

Acanthopanax sieboldianus (*Aralia pentaphylla*) (4)

FIVE-LEAF ARALIA

Shade-tolerant shrub to 6-8 ft. with small palmately divided leaves retained until late autumn. Thorny. Good for city conditions and for hedges. Flowers inconspicuous. FO, LI, LT, ML, SH, SQ, WN, 5, 10, 28.

Aralia

Aralia elata (4)

JAPANESE ANGELICA-TREE

Tall spiny shrub or small tree with large doubly compound leaves. Sparsely branched. Umbels of white flowers in mid-summer. Tropical appearance. ED, FO, LI, ML, SH.

Chokeberry

Aronia arbutifolia (4)

RED CHOKEBERRY

Lanky shrub to 7 ft. or more. Attractive small white flowers in mid-May. Autumn foliage usually red, as is the fruit, which sometimes persists into winter. Good for wild-life plantings. FO, GA, KR, LT, MK, ML, PF, 5, 9, 21, 32, 36. *Selected Form*: 'Brilliantissima' Numerous brightly colored berries. BA, LI, PF, RO, SH, SQ, WB, WN, 3, 5, 6, 16, 21, 28, 36.

Aronia melanocarpa (4)

BLACK CHOKEBERRY

Smaller than the preceding. Berries purplish-black. BA, FA, FO, GA, ML, 5, 9, 15, 21, 28.

Aucuba

Aucuba japonica (7-6B)

JAPANESE AUCUBA

Stout, eventually tall-growing shrub with thick glossy evergreen leaves. Dioecious, with pistillate plants bearing bright red berries. Best planted in shade. Hardier than forms with variegated leaves. BR, EA, ED, GE, PT, WB, 14, 20, 30, 43, 46. *Selected Forms*:

'Crotonifolia.' Leaves spotted white. WA, 4, 23, 30, 42, 46.

'Picturata.' Leaf-center yellow. BH, 4, 23, 42, 43, 44, 46.

'Variegata.' GOLD DUST TREE. Shrub with leaves spotted yellow. BH, BR, DA, EA, ED, GE, HA, ML, PT, WB, 4, 14, 17, 20, 23, 30, 36, 42, 43, 44, 46.

Barberry

Berberis chenaultii (*verruculosa* × *gagnepainii*) (5)

CHENAULT BARBERRY

Evergreen shrub, slow-growing to 4 ft. Refined small leaves. BR, LI, MD, RK, WA, 9, 20, 22, 42, 44.

Berberis julianae (5)

WINTERGREEN BARBERRY

Evergreen shrub to 6 ft. with larger, less refined leaves than most evergreen barberries, but of reliable hardiness. Some leaves turn brilliant orange-red in autumn, others remain green. BR, EA, ED, GE, HY, ML, PF, RO, SH, SQ, WB, 10, 21, 28, 33, 36, 38, 41, 42, 44. *Selected Form*: 'Nana.' Dense, to 3-4 ft. CB, DA, GE, SH, 20, 22, 36, 41.

'William Penn,' a hybrid with *B. verruculosa*, is a smaller shrub than *B. julianae* and has slightly more refined foliage. RO, 28, 44.

Berberis koreana (4-3B)

KOREAN BARBERRY

Dense deciduous shrub to 5-6 ft. with leaves turning dark red in autumn. Persistent red fruit. BR, DE, LI, VA, 36.

Berberis mentorensis (*julianae* × *thunbergii*) (5-4B)

MENTOR BARBERRY

Dense shrub to 5-6 ft. with leaves held late into autumn. Reported to withstand hot dry midwestern summers better than other barberries. DA, GE, HE, KS, LC, LT, ML, RO, ST, WG, WN, 5, 10, 11, 21, 25, 28, 31, 36, 44.

Berberis thunbergii (4)

JAPANESE BARBERRY

Common deciduous shrub to 5-6 ft., often used for hedges because of its dense growth, thorniness and small leaves. Fine red autumn color. Red berries held into winter. Tolerant of a wide range of conditions. BT, CO, EM, GU, KE, KS, MB, MU, RS, SH,

SI, ST, WB, 3, 5, 6, 10, 15, 28, 30, 31, 42, 44.* *Selected Forms:*

'Atropurpurea.' PURPLE-LEAF BARBERRY. BT, CO, EM, FE, GU, KE, KS, MB, MU, NE, RS, SH, ST, WB, 3, 5, 6, 10, 15, 16, 19, 28, 30, 31, 42, 44, 46.*

'Aurea.' Leaves bright yellow if grown in full sun. Slow-growing. BU, CB, FA, FE, KR, ML, PR, WG.

'Erecta.' Erect, compact form useful for hedges. BA, CO, ED, LC, ST, 31.

'Rosy Glow.' Leaves first purple, then with white markings. A novelty, but handsome if properly used. ED, KE, SR.

'Thornless.' BA, FO, MK, ST.

For other barberries see page 64.

Boxwood

Buxus microphylla. *See page 65.*

Buxus sempervirens (6-5B)

COMMON BOX

Dense evergreen shrub to 10 ft. or more. Best development occurs in the mid-Atlantic states. Subject to snow damage and winter burn northwards. A common hedge plant in the South. Many kinds. EA, ED, GA, GE, HY, LT, PF, PT, RO, WB, WN, 11, 14, 19, 20, 21, 28, 30, 33, 36, 41, 43, 45. *Selected Form:* **'Inglis.'** Densely pyramidal. Satisfactory in colder areas. EA, 42. *See also page 65.*

Beauty-berry

Callicarpa dichotoma (purpurea) (5-4B)

KOREAN BEAUTY-BERRY

Upright shrub to 6-7 ft. Distinctive small lilac-violet berries in autumn. DA, DU, EA, LI, NE, RK, VI, 41.

Callicarpa japonica 'Leucocarpa' (5)

WHITE-FRUITED BEAUTY-BERRY

To 5 ft. or more. Small but abundant white berries persisting in autumn. One of the best shrubs with white fruits. FO, WG, WN.

Pea-shrub

Caragana arborescens (3-2B)

SIBERIAN PEA-SHRUB

Tall upright shrub with fairly refined small compound leaves. Bright green. Yellow pea-like flowers in mid-spring. Mainly for the Northern Plains. Hedge plant. DU, GU, HE, LC, LI, ML, PV, SH, ZI, 31, 32, 39. *Selected Form:* **'Lorbergii.'** Feathery leaves. AE, ML, SH, 8, 17, 22.

Caragana microphylla (3)

Shrub to 6 ft. or more with long spreading branches. Tiny leaflets. KS.

Cleyera

Cleyera japonica (7)

Tall shrub with glossy evergreen leaves. New growth red. Fragrant white flowers in summer followed by red berries. A choice plant for southern gardens. IIA, PR, 12, 20.

Dogwood

Cornus alba (3-2B)

Vigorous shrub to 7 ft. or more. Grown for its winter twig color; also for the variegated leaves of some forms. The latter are more tender. Whitish berries have some late summer interest. *Forms grown for their bright red winter twigs:*

'Coral Beauty.' BA, VI, WG.

'Sibirica.' This and others should be pruned severely in very early spring to encourage strong new growth that will have good color the following winter. CO, FE, LT, MK, RO, RS, SH, WN, 3, 5, 9, 10, 16, 21, 28, 31, 32, 42.

'Westonbirt.' (Siberica?). CB, WN.

Forms grown for their variegated leaves:

'Argenteo - Marginata' (**'Elegantissima'**). Leaf margins white. CB, CO, EM, FA, FE, GU, KE, RS, SH, SR, VI, 5, 10, 16, 32.

'Gouchaltii.' Leaves variegated yellow and pink. CO, DE, FO.

'Spaethii.' Leaves with yellow margins. ED, SH.

Cornus amomum (5)

SILKY DOGWOOD

Strong-growing shrub to 7-8 ft. Pale blue berries in summer. Dark red twigs in winter. DU, MK, SN, 28.

Cornus racemosa (paniculata) (4)

GRAY DOGWOOD

To 10-12 ft. White berries on red stalks in early summer. As with other shrubby dogwoods, the clusters of small white flowers are not especially conspicuous. Most are good wild-life shrubs, appearing their best in naturalized parts of the garden. BA, DU, HE, LI, LT, MK, MU, SI, SN, WN, 5, 11, 15, 21, 28, 32.

Cornus sanguinea (4)

BLOOD-TWIG DOGWOOD

To about 8 ft. Black berries in autumn. Like most shrubby dogwoods, foliage turns red in autumn. HY, SI, WN, 20, 21.

Cornus sericea (stolonifera) (2)

RED OSIER DOGWOOD

Robust, tall, suckering shrub with white berries in summer and bright red winter twigs. Suited for moist spots. CO, GE, LT, ML, PF, PW, RO, SH, SI, 5, 15, 21, 28, 31, 32. *Selected Form:* **'Flaviramea'** (**'Lu-**

tea'). Twigs bright yellow in winter. KR, KS, LT, PF, PV, RO, RS, SH, SQ, WN, ZI, 5, 9, 10, 16, 21, 28, 31, 32.

Hazelnut, Filbert

Corylus americana (4)

AMERICAN HAZELNUT

Shrub to 5 ft. or more. The edible nuts are usually smaller than those of *C. avellana*. An addition to wild-life plantings. BO, DU, FE, MK, ML, RK, RO, SN, ST, 5, 15, 21, 28, 32.

Corylus avellana (4)

EUROPEAN HAZELNUT

Tall spreading shrub to 15 ft. or more. Catkins attractive in late winter. Often cultivated for nuts. BO, BT, CA, EM, MA, ML, 36. *Selected Form*: 'Contorta.' Shrub to 6-7 ft. with sharply twisted branches. An apt catalog name is "Harry Lauder's Walking Stick." Not grown for its nuts. BA, CB, KR, LI, LN, OL, PR, RO, SH, SR, VI, WF, WG, ZI, 17, 21, 28, 36, 38, 42.

Corylus maxima 'Purpurea' (5)

PURPLE-LEAF FILBERT

Shrub to 10 ft. or more. Leaf color most intense in spring. Full sun. ED, FO, LI, SH, WE, WG, ZI, 5, 17.

Smoke-bush

Cotinus coggygia (*Rhus cotinus*) (4)

Loosely branched shrub to 10-12 ft. with green leaves. Fluffy gray-to-purple fruiting panicles in summer. Since some plants may have entirely staminate ("male") flowers, it is wise to seek out cutting-grown plants with conspicuous fruit heads. Autumn color orange-to-yellow. CO, KR, LT, ML, PW, RI, RK, RO, SH, SR, VI, 15, 21, 31. *Selected Form*: 'Royal Purple.' Purplish leaves and fruit heads. BA, BR, BU, CO, FA, IN, RO, SR, TE, 38, 42, 45.

Cotoneaster

Cotoneaster acutifolia (5)

PEKING COTONEASTER

Tall upright shrub with dull green leaves 2-in. long. Black fruit. Many of the plants in the trade may be *C. lucida*, which has lustrous foliage. AE, CO, DE, DU, FA, FE, KS, MB, ML, RS, 5, 16, 21, 31, 32.

Cotoneaster divaricata (5-4B)

SPREADING COTONEASTER

Shrub to 5-6 ft. with arching branches and glossy dark green leaves. Leaves small, rather closely set. Bright red berries in autumn. Probably the most refined cotton-

easter of medium size. DU, EM, GE, HY, KE, KR, MB, ML, PF, RO, WG, 1, 3, 5, 6, 9, 16, 19, 21, 28, 32, 41, 44.*

Cotoneaster foveolata (4)

GLOSSY COTONEASTER

To 6-8 ft. The shiny thick green leaves turn orange or scarlet in autumn. Black berries. LI.

Cotoneaster franchetii (6-5B)

Shrub to 8 ft. with leaves retained late in autumn. Small orange-red berries. EA, HY, WN, 14, 28.

Cotoneaster glaucophylla (7)

BRIGHT-BEAD COTONEASTER

Dense evergreen shrub to 6-8 ft. with bright red berries ripening late in the season. CB, PT, SI, 19, 20, 23, 26, 30, 41, 44.

Cotoneaster integerrima (5)

Rounded shrub to about 5 ft. Many short stiff twigs. Red berries. BA, DE, KS, MK, PV, VA, 32.

Cotoneaster pannosa (7)

SILVER-LEAF COTONEASTER

Dense shrub with rather small silvery leaves retained far into winter. PT, SI, 30, 46. *Selected Form*: 'Nana.' SI.

Cotoneaster salicifolia (6)

WILLOW-LEAF COTONEASTER

To 6 ft. or more; 3-in.-long glossy leaves held late in autumn. Nearly evergreen in the South. Red berries. *Selected Form*: *var. floccosa*. Hardier than the species. CB, DA, WN, 40.

For other cotoneasters see pages 41, 66.

Cyrilla

Cyrilla racemiflora (5)

Splendid southern shrub native from Virginia to Florida (but hardy in the North) to 10 ft. or more. Attractive pendulous racemes of seed heads held long into autumn. Fiery fall color, especially pretty because the shiny green leaves do not turn completely red at one time. It needs a peaty soil which holds moisture. Fine for bonsai. 22, 36.

Elaeagnus

Elaeagnus angustifolia

RUSSIAN-OLIVE. See page 11.

Elaeagnus commutata (2)

SILVERBERRY

Thornless upright shrub to 8 ft. with attractive silvery leaves and silver berries. Suckers strongly, but useful where it is native—from Alaska to Minnesota. DE, DU, SH, VA.

Elaeagnus multiflora (4)**CHERRY ELAEAGNUS**

Large spreading shrub with inconspicuous but fragrant flowers in early May. Tart though edible red berries in early summer. DU, SH, 21.

Elaeagnus pungens (7-6B)**THORNY ELAEAGNUS**

Dense, broad and eventually tall evergreen shrub. Common in the South, but hardy in slightly protected sites as far north as Long Island. Intensely fragrant small flowers, especially valued for their appearance in October. EA, PT, SI, 30. *Selected Form:* 'Fruitland.' Rounded leaves with wavy margins. CB, GE, HA, ML, WB, 12, 14, 36, 44.

Elaeagnus umbellata (4-3B)**AUTUMN ELAEAGNUS**

Tall spreading shrub with silvery-brown berries turning red in autumn. Young foliage silvery, later dark green. DU, EM, KE, LI, PF, RO, SH, WN, 3, 20, 21, 28. *Named Form:* 'Cardinal.' A strain developed for profuse fruit production. Useful in wild-life plantings. FE, RO, 5, 15, 44.

Euonymus**Euonymus alatus (3)****WINGED EUONYMUS**

Shrub to 8 ft. with corky twigs. Brilliant rose-scarlet autumn color. Conspicuous fruit. CB, HY, KS, LN, LT, MB, ML, PF, RO, SH, SR, WB, ZI, 1, 3, 5, 6, 7, 28, 32. *Selected Form:* 'Compactus.' Dense, to about 5 ft. A fine hedge where scale insects are not bothersome. Memorable autumn color. ED, FE, GI, IN, KR, KS, LA, LI, MA, NE, ST, VI, WG, 5, 16, 20, 28, 31, 35, 41.*

Euonymus europaeus 'Aldenhamensis' (4-3B)**ALDENHAM SPINDLE-TREE**

Shrub to 8 ft. or more with dark green leaves. Abundant reddish-pink fruit in autumn. BA, HE, SH, WG, WN, 5, 6.

Euonymus japonicus (7-6B)**JAPANESE EUONYMUS**

Upright evergreen shrub to 8-10 ft. Fresh dark green leaves. Often used for hedges in mild climates. Japanese euonymus and forms: BH, ED, MD, PT, RO, 30, 38, 43, 44, 46.

Euonymus kiautschovicus (patens) (6-5B)**SPREADING EUONYMUS**

Rather loose half-evergreen shrub to 6 ft. Shiny dark green leaves give the appearance of being evergreen in summer. EA, GE, RO, SQ, ST, 9, 21, 28, 31, 4. *Selected*

Form: 'Manhattan.' IN, KS, LI, ML, RO, WB, WG, 1, 20, 30, 44.

Euonymus yedoensis (4)**YEDDO EUONYMUS**

Large spreading shrub with pink fruit and brilliant red autumn color. DU, LC, LI, MK.

For other Euonymus see page 68.

Sea-buckthorn**Hippophae rhamnoides (2)**

Open shrub to about 12 ft. with silvery leaves. Bright orange berries retained into winter. Dioecious. DE, SH, VA, VI, WG.

Holly**Ilex aquifolium**

ENGLISH HOLLY. *See Evergreen Trees, page 30.*

Ilex aquipernyi (aquifolium × pernyi) (6B)

Evergreen shrub to 12 ft. or more in the South, much less in the North. Twisted small spiny leaves. This and similar evergreen hollies benefit from winter shade on Long Island. PK, RF, 40, 43. *Selected Form:* 'Brilliant.' Abundant red berries. MD, 20, 26, 30.

Ilex cassine (7)**DAHOO**

Evergreen shrub to 10 ft. or more. Abundant red berries. Leaves spineless. An attractive shrub especially suitable for moist soils. GE, 11.

Ilex ciliispinosa (6B)

Upright evergreen shrub to 8 ft. or more. Spiny leaves 1-1½ in. long. Bright red berries. BR, WA, 41.

Ilex cornuta (6B)**CHINESE HOLLY**

Evergreen shrub to 6 ft. or more. Glossy leaves with 3-pointed tips. Red berries produced on pistillate plants without pollination, but for best fruit production it may be advisable to also plant staminate plants. BH, EA, GE, PT, VI, WO, 14, 30, 43, 46. *Selected Forms:*

'Burfordii.' BURFORD HOLLY. Leaves usually spineless, short-tipped. Pistillate. CB, EA, GI, ML, PF, PT, SI, WB, WO, 1, 12, 14, 19, 21, 30, 36, 40, 42, 43, 46.

'Burfordii Nana.' Similar to the preceding, but to 3-4 ft. CB, GE, HA, PR, 11, 12, 14, 20, 23, 26, 30, 42, 43, 44, 46.

'Rotunda.' Compact, slow-growing form with somewhat rounded spineless leaves. Pistillate. BH, CB, GE, HA, PT, RI, RO, 11, 12, 13, 14, 19, 20, 23, 25, 26, 30, 36, 43, 44, 46.

Ilex crenata (5)**JAPANESE HOLLY**

Dense evergreen shrub to 15 ft. or more. Leaves usually about 1-in. long, but variable. Inconspicuous black berries. Some forms are among the finest broad-leaf evergreens planted in the North. Moderately shade-tolerant. Bonsai, especially small-leaf forms. EA, HY, PF, RO, SI, WB, 10, 21, 33, 38, 40, 42. *Selected Forms:*

'Compacta.' CB, HA, HY, VI, 30, 35, 36, 41, 44.

'Convexa' ('Bullata'). **BOX-LEAF HOLLY.** Dense, to 6-ft., with small convex leaves. Fine hedge. CB, EA, ED, GE, GI, HY, LI, LT, MU, PF, RO, WB, WN, 1, 9, 10, 14, 15, 19, 21, 28, 33, 35, 36, 38, 42.*

'Microphylla.' Dense upright shrub to 6 ft. Fairly small leaves. GE, PF, RO, SQ, WB, WO, 9, 14, 20, 21, 28, 38.

'Rotundifolia.' To 5-6 ft. Comparatively wide short leaves. CB, EA, ED, EM, GE, GI, HA, LI, ML, PF, RO, SQ, WB, 1, 9, 10, 11, 14, 15, 19, 21, 25, 33, 36, 38.

For other Japanese hollies see page 70.

Ilex decidua 'Warren Red' (5)**POSSUM HAW FORM**

Deciduous shrub to 8 ft. or more. Profuse red berries. Thick lustrous foliage. Said to be receptive to pollen of *I. opaca*. 34. *Other Form:*

'Byers Golden.' Yellow berries. Available from Byers Nursery, 7002 North Memorial Parkway, Huntsville, Alabama 35811. (Wholesale only.)

Ilex glabra (4)**INKBERRY**

Loose evergreen shrub to 6 ft. or more. Shiny dark green leaves about 1-in. long, not spiny. Suited to moist soils. DA, EA, GE, HY, KI, LT, ML, PF, RO, SQ, WN, 10, 20, 28. *Selected Forms:*

'Compacta.' Dense, to 4-5 ft. CB, GI, LI, RO, 15, 20, 21, 28, 34, 36, 38.

'Ivory Queen.' Berries white. WA, WO.

Ilex laevigata (4)

Deciduous shrub to about 6 ft. Red berries produced on pistillate plants without pollination. Otherwise, much like *I. verticillata* except for its shiny leaves. LI, LN.

Ilex 'Nellie Stevens' (aquifolium × cornuta) (6)

Evergreen shrub to 8 ft. or more. Red berries produced without pollination, but more abundant fruit occurs when grown near staminate plants of English holly or 'Edward Stevens' (no source known). CB, EA, RK, 20, 23, 36, 41, 44, 45.

Ilex opaca

AMERICAN HOLLY. *See page 30.*

Ilex pedunculosa (6-5B)

Evergreen shrub or small tree to 10 ft. or more. Leaves spineless, similar to mountain-laurel. Pistillate plants have red berries on long stalks, and as with most hollies, staminate plants are needed for fruit set. BR, DA, PF, RO, WA, 21, 22, 35, 36.

Ilex pernyi (6)

Evergreen shrub to 10 ft. or more. Pyramidal in youth. Very small, squat, spiny leaves. Clusters of red berries. BR, DA, MF, ML, SI, WA, 11, 22, 30, 33, 36, 40, 44.

Ilex serrata (5-4B)**JAPANESE WINTERBERRY**

Similar to *I. verticillata*, but with smaller red berries abundantly borne. Bonsai. BR, 34, 36, 38.

Ilex verticillata (3)**WINTERBERRY (BLACK-ALDER HOLLY)**

Open deciduous shrub to 7 ft. or more. Bright red berries sometimes retained far into winter. Variable. Tolerant of moist soils. GA, LI, LN, MB, ML, PF, PW, RO, SH, SN, WB, WG, WN, 5, 6, 10, 15, 21, 28, 31, 34, 36. *Named Form:* 'Christmas Cheer.' CB, 17.

Ilex vomitoria (7)**YAUPON**

Tall evergreen shrub or small tree. Red berries prolifically borne on pistillate plants. Drought-resistant. Occasionally used for clipped hedges. GE, 14, 46. *Selected Form:* 'Nana.' SI, 12, 13, 14, 19, 30, 44.

Ilex 'Wilsonii' (6B)

Vigorous, eventually large shrub. Large evergreen leaves, usually with even toothed. Foliage not as lustrous as in English holly. Pistillate. EA, 30, 43, 44, 46.

Sweet Bay, Laurel**Laurus nobilis (6B)**

Tall shrub with aromatic evergreen leaves, 3-4 in. long. Shears well and is sometimes grown as a tub plant. Dies back to the ground in New York City each winter but is root hardy if mulched. BH, PT, 30, 36, 43.

Privet**Ligustrum amurense (4-3B)****AMUR PRIVET**

Pyramidal shrub to 10 ft. or more. Widely used as a hedge in northern areas where the similar California privet is not reliably hardy. All of the common privets are

tolerant of a wide range of growing conditions. BT, CO, FE, KE, LT, MB, MK, ML, MU, NE, SH, SQ, WE, WG, 10, 21, 28, 31.

Ligustrum ibolium (ovalifolium \times obtusifolium) (4)

Vigorous upright shrub much like California privet but hardier. CO, LI, LT, PW, SH, SQ, WE, 3, 6, 10, 20, 21, 28, 31.

Ligustrum japonicum (7)

JAPANESE PRIVET

Evergreen shrub to 8 ft. or more. Lustrous, 4-in.-long deep green leaves with dark red margins. This and the similar *L. lucidum* are probably the finest privets, but they are tender in many parts of the country. BH, GE, 30, 43, 44, 46. *Selected Form*: 'Rotundifolium' ('Coriaceum'). ROUND-LEAF PRIVET. Slow-growing to about 6 ft. Thick coin-like leaves. EA, 12, 20, 22, 23, 30, 36.

Ligustrum lucidum (7)

GLOSSY PRIVET

Evergreen shrub to 10 ft. or more, sometimes a small tree. Shiny leaves up to 6-in. long. BH, DA, EA, GE, HA, WB, 11, 12, 13, 14, 19, 20, 36.

Ligustrum ovalifolium (5)

CALIFORNIA PRIVET

Familial hedge shrub to 10 ft. or more. Shiny leaves sometimes persist into winter. A native of Japan despite the common name. North of New York City, Amur privet is more reliably hardy. Like most privets, it is tolerant of poor soil and shade. BT, RO, 11, 21, 28, 31.

Ligustrum sinense (6)

CHINESE PRIVET

Tall shrub or small tree with attractive panicles of white flowers in early summer. LI, RI, SI, 11.

For other privets see page 71.

Spice-bush

Lindera benzoin (Benzoin aestivale) (4)

Aromatic shrub to 8 ft. or more. Small yellow flowers in early spring. Useful for moist soils and naturalized areas. DU, EM, FO, GA, LI, RO, SQ, WN, 5, 11, 21, 28.

Honeysuckle

Lonicera. See page 44 and 71.

Mahonia

Mahonia bealei (6)

LEATHER-LEAF MAHONIA

Stiff evergreen shrub to 6 ft. or more.

Coarse bluish-green compound leaves. Attractive small yellow flowers and conspicuous grape-like berries. Useful for foliage contrast. Shade. BH, BR, CB, DA, EA, FO, GE, GO, KI, ML, VI, 14, 17, 20, 22, 30, 41, 43, 44, 46.

Mahonia pinnata (6)

Similar to *M. aquifolium* (see page 71), but eventually to 8 ft. or more. Duller, usually more numerous evergreen leaflets. Pale yellow flowers in clustered racemes. LI, RI, 15, 25, 41, 44, 46.

Bayberry

Myrica cerifera (6-5B)

WAX-MYRTLE

Evergreen shrub to 8 ft. or more; 2-3-in.-long aromatic leaves. Berries silvery gray. Dioecious. EA, 20.

Myrica pensylvanica (2)

NORTHERN BAYBERRY

Similar to the preceding, but deciduous and much hardier. Thrives in sandy soil. DA, FO, GD, LI, LT, ML, RO, SH, SQ, WN, 1, 5, 9, 15, 21, 28, 36.

Heavenly-bamboo

Nandina domestica (7)

Stiffly upright shrub to 6-8 ft. with large clusters of bright red berries in autumn. Brilliant scarlet autumn color. Leaves retained through the year. BH, DA, EA, GE, ML, PF, PT, SI, WB, 11, 12, 14, 20, 23, 26, 30, 33, 36, 42, 43, 44, 46. *Selected Form*: 'Compacta.' To 3-4 ft. PT, RI, SI, WA, 44, 46.

Osmanthus

Osmanthus fortunei (heterophyllus \times fragrans) (7)

Vigorous evergreen shrub to 8 ft. or more. Small fragrant flowers in late spring; 3-4-in.-long holly-like leaves. GE, WB, 14, 36.

Osmanthus heterophyllus (ilicifolius) (6)

HOLLY OSMANTHUS

Tall dense evergreen shrub with leaves remarkably similar to English holly, but arranged in pairs along the stem. Fragrant small flowers in late summer. DA, EA, GE, PT, WB, 14, 20, 23, 36. *Selected Forms*: 'Gulf Tide.' Slow-growing, compact. CB, 20, 23, 30, 44. 'Rotundifolius.' Twisted, somewhat rounded, nearly spineless leaves. Slow-growing, perhaps to 4 ft. or more. DA, EA, WA, 36. Variegated-leaf forms. PR, PT, 12, 19, 23, 26, 44.

Mock-orange

Philadelphus coronarius 'Aureus' (4)

GOLDEN MOCK-ORANGE

To 5-6 ft., with leaves golden-yellow in spring. Full sun. CO, FA, FE, FO, GU, RS, SH, WE, 5, 10, 16, 31, 32.

For other *Philadelphus* see page 45.

Photinia

Photinia fraseri (7)

FRASER PHOTINIA

Vigorous tall evergreen shrub with reddish new growth through the summer. Large shiny leaves and attractive white flowers. Hybrid origin: *P. glabra* × *serrulata*. The form available is a cultivar, 'Birmingham,' but it is known in the trade simply as Fraser photinia. Tips of shoots suffer winter injury in New York City, but these may be easily pruned out in early spring. First-rate. BH, ED, ML, PT, RI, 4, 12, 14, 17, 23, 30, 33, 42, 43, 44, 46.

Photinia glabra (7)

JAPANESE PHOTINIA

Handsome evergreen shrub to 7-8 ft. with shiny leaves 3-4 in. long; 4-in.-wide flower clusters in mid-spring. Red berries in autumn. GE, 30, 33, 42.

Photinia serrulata (7)

CHINESE PHOTINIA

Attractive tall shrub or small tree with lustrous evergreen leaves. White flowers in 6-in. heads. Red berries in autumn. EA, MD, 4, 12, 30, 43, 46.

Photinia villosa (5-4B)

ORIENTAL PHOTINIA

Spreading deciduous shrub to 8-10 ft. with generally good red or orange-yellow autumn color and persistent red berries. Moderately attractive white flowers in mid-May. DU, LI, ML, RO, 7, 9, 28, 36.

Eastern Ninebark

Physocarpus opulifolius (3-2B)

Vigorous shrub to 8 ft. or more with small maple-like leaves. Leggy. Conspicuous clusters of small white flowers in late May, followed by decorative red seed pods. Peeling bark. FO, MK, WB. *Selected Forms:*

'Luteus' ('Aureus'). GOLDEN NINEBARK. Leaves bright yellow in spring. Full sun. BA, CO, DE, FE, FO, MB, PV, SH, WE, 11, 32.

'Nanus.' DWARF NINEBARK. Dense, to 4-5 ft. More refined than the species. CO, MK, PV, RI, RS, SI, ST, 32.

Trifoliolate-orange

Poncirus (Citrus) trifoliata (6-5B)

Handsome, dense, thorny shrub with green twigs in youth; small open tree with picturesque smooth brown bark at maturity. Small waxy leaves. Two-in.-wide white flowers in April. Small oranges, first cousins to the true orange, are colorful in autumn, but suitable only for marmalade. Minor twig damage occurs on Long Island in a severe winter. A satisfactory hedge southwards. BR, GE, PF, RO, WA, 20, 36.

Cherry, Cherry-laurel, Plum

Prunus cistena (2)

PURPLE-LEAF SAND CHERRY

Shrub to 6-7 ft. with purplish-red leaves. Small white flowers in early May. Purplish-black fruit. AE, BA, CO, FA, GU, ML, RK, RS, WE, WG, WN, 15, 16, 19, 31, 32.

Prunus laurocerasus (6)

CHERRY-LAUREL

Shrub to about 10 ft. with lustrous evergreen leaves. Racemes of white flowers in mid-May. EA, ED, GE, PT, 12, 42, 44.

Selected Forms:

'Otto Luyken.' To about 3 ft; twice as broad. ED, PR, RK, WA, 22, 23, 33, 42, 44. Var. *schipkaensis* (5-4B). Dense, to 5 ft. or more, usually broader than tall. Five-in.-long shiny leaves. DA, GE, LI, WB, WN, 14, 20, 22, 42.

'Zabeliana.' Small leaves. CB, ED, LI, MA, ML, WB, 14, 20, 23, 33, 40, 42.

Prunus maritima (3)

BEACH PLUM

Spreading shrub to 6 ft. with handsome white flowers in late April. Small edible plums in late summer. Satisfactory under inland as well as coastal conditions. FO, LI, LN, PF, RO, WN, 5, 6, 15, 21, 28, 36.

For other *Prunus* see pages 15, 26, 45.

Firethorn, Pyracantha

Pyracantha atlantioides 'Aurea' (6)

GIBBS YELLOW FIRETHORN

Similar to *P. coccinea* forms, but taller. Birds ignore the yellow berries which remain attractive until late autumn. Half-evergreen. 1, 20, 28, 36, 41, 44.

Pyracantha coccinea (6)

SCARLET FIRETHORN

Strong-growing, semi-evergreen shrub to 6 ft. or more. Attractive small white flower clusters in late May or early June. Numerous red or reddish-orange berries

in autumn. Birds quickly devour the ripened berries of some firethorns while ignoring others. Evergreen southwards. Frequently espaliered. Beginner's bonsai. The species is usually sold in its forms.

Selected Forms:

'Kasan.' Hardy in Zone 5. Fruits orange-red. BU, CB, CO, IN, LI, PV, PW, SH, 1, 23, 36, 38, 41, 42, 45.

'Lalandei.' More-or-less hardy in Zone 5. Vigorous, almost rank grower to 8-10 ft. Fruits scarlet-red. CB, CO, EM, GI, HY, LT, RK, RO, SQ, ST, VI, WB, WF, 1, 9, 19, 21, 28, 30, 36, 38, 40, 41, 42.

'Lowboy.' To 3-5 ft. DA, LI, MD, ML, OL, RO, SH, SI, 9, 20, 21, 28, 33, 36, 38, 41, 44.

Other species and forms: BH, CB, EA, EM, KR, KS, LI, MD, ML, PT, RK, RO, 1, 23, 30, 33, 36, 42, 44, 45.

Buckthorn

Rhamnus cathartica (3)

COMMON BUCKTHORN

Vigorous shrub to 10-12 ft., often a small tree at maturity. Lustrous foliage. Although not a first-rate ornamental, buckthorn may be useful in conservation plantings because of its black berries, a source of wild-life food. DU, FO, MK, VA.

Rhamnus frangula 'Columnaris' (3)

TALL-HEDGE BUCKTHORN

Vigorous narrow columnar shrub to 12 ft. or more, useful for hedges. Shiny green leaves. BU, EM, FA, FO, KE, KS, ML, MU, RO, RS, WN, 3, 5, 7, 16, 21, 28, 42.

Sumac

Rhus aromatica. *See page 74.*

Rhus copallina (5-4B)

SHINING SUMAC

Tall shrub or small tree with lustrous deep green leaves with winged midribs. Scarlet autumn color and crimson fruits. Less coarse than the following two species. DU, GA, RI, SI, 21, 28.

Rhus glabra (3)

SMOOTH SUMAC

Shrub to 8-10 ft. with leaves bright red in autumn. Fruits scarlet. DU, GE, HE, KS, LN, SH, SN, VA, 15, 21, 28, 31, 32.

Rhus typhina (3-2B)

STAGHORN SUMAC

Sparsely branched open shrub or a small tree to 10 ft. or more. Velvety twigs. Clump-forming, like the preceding two. Brilliant orange-scarlet autumn color. DU, ED, GA, KS, LN, SH, SI, SN, 28, 31, 32.

Selected Form: **'Laciniata.'** CUT-LEAF SUMAC. Very graceful. BA, DU, ED, LN, SH, SR, VA, 22, 32.

Alpine Currant

Ribes alpinum (3-2B)

Compact shrub to 5-6 ft. with refined small maple-like leaves. Useful for hedges in cold climates. Many currants serve as alternate hosts for white pine blister rust and should not be planted where 5-needle pines are common. The staminate form of *R. alpinum* is reportedly immune. CO, ED, EM, FA, FE, KE, KS, MB, RO, RS, SH, WE, WG, 16, 31, 32.

For other currants see page 49.

Rose

Rosa rubrifolia (3)

RED-LEAF ROSE

Shrub to about 5 ft. with dark red flowers in late May. Dull reddish-green foliage. CO, KN, SH, TI, VA, WY.

For other roses see page 50.

Willow

Salix elaeagnos (incana) (4)

ROSEMARY WILLOW

Handsome large spreading shrub with foliage silvery from a distance. Similar to Russian-olive but the leaves are more narrow. FO, 22.

Salix purpurea (4-3B)

PURPLE OSIER

Spreading shrub to 10 ft. or more. Purplish twigs. Leaves bluish beneath. BA.

Salix sachalinensis 'Sekka' (4)

FAN-TAIL WILLOW

Sprawling shrub with twisted and often flattened (fasciated) twigs. Useful in winter arrangements. A curiosity. BA, GI, HA, IN, ML, WA, 10, 16.

For other willows see pages 16, 50.

Elder

Sambucus canadensis (3)

AMERICAN ELDER

Loose vigorous suckering shrub to 10-12 ft., with coarse compound leaves. Showy flat cymes of white flowers in early summer, followed by edible purplish-black berries. Mainly for wet sites or for wild-life plantings. DU, EM, FA, KE, MK, ZI, 28.

Selected Forms:

'Acutiloba.' Cut-leaved. FO, MK.

'Aurea.' Yellow leaves. AE, BA, CO, FO, KS, MK, RS, 16, 31.

Sambucus pubens (3-2B)**AMERICAN RED ELDER**

Shrub to about 8 ft. with dome-shaped white flower clusters in early spring and attractive red berries in early summer. Otherwise similar to *S. canadensis*. DU, SN.

Buffalo-berry**Shepherdia argentea (3-2B)**

Tall spiny shrub with silvery leaves and twigs. Edible scarlet berries in late summer. Dioecious. Tolerant of poor, dry soil and sometimes used as a hedge in colder areas. AE, DE, KS.

Shepherdia canadensis (2)**RUSSET BUFFALO-BERRY**

Thornless open-branched shrub to 5-6 ft. with gray-green leaves. Sweet yellowish-red berries in early summer. Dioecious. Tolerant of dry and alkaline soils. DE.

Snowberry**Symphoricarpos albus laevigatus (3)****SNOWBERRY**

Shrub to 5-6 ft. with attractive ½-in.-wide white berries in late summer and autumn. Suckering. Flowers not showy. Invariably sold as *S. albus*. EM, GI, GU, KE, ML, PF, RO, RS, SH, SQ, WB, 10, 2S, 31, 32.

Symphoricarpos chenaultii (microphyllus × orbiculatus) (5)**CHENAULT CORALBERRY**

Suckering shrub to 3-4 ft. with small leaves. Small red berries, whitish beneath. Useful as a bank cover or in a wild-life planting. DU, EM, GI, KE, MK, ML, PF, RO, SH, SI, SQ, ST, WN, 3, 5, 10, 2S, 32. *Selected Form: 'Hancock.'* Dwarf spreading shrub suitable for a rough ground cover on dry banks. DU, LC, PF, SH, 3, 10, 11, 2S.

Symphoricarpos 'Mother of Pearl' (4?)

To 4-5 ft. Large light pink berries. A hybrid of snowberry and coralberry. CO, 10.

Symphoricarpos orbiculatus (vulgaris) (3)**INDIAN CURRANT, CORALBERRY**

Similar to *S. chenaultii*. Berries purplish-red, smaller. Suckering. Bank cover. CO, FO, GE, LT, MK, PF, RS, SH, 5, 11, 21, 2S, 31.

Asiatic Sweetleaf**Symplocos paniculata (5)**

Tall shrub or small tree with small clusters of fragrant white flowers in mid-May.

Handsome sapphire-blue berries in early autumn which unfortunately do not last long. DA, DU, PF, RO, 36, 3S.

High-bush Blueberry**Vaccinium corymbosum (4-3B)**

Dense twiggy shrub growing slowly to 8 ft. Dainty heath-like white flowers in May. Orange-scarlet autumn color. Acid soil. Many forms cultivated for fruit. BO, CO, DU, EM, FA, FE, GA, GE, GI, KE, WN, ZI, 6, 21, 2S.*

Viburnum**Viburnum acerifolium (3)****MAPLE-LEAF VIBURNUM**

Loose shrub to 4-5 ft. Crimson autumn color and black berries. For a shady spot in the naturalized garden. Except for snowball forms, most viburnums are good wild-life shrubs because of their berries. They generally have good dark red autumn foliage. DU, FO, SN, 2S

Viburnum alnifolium (3)**HOBBLE-BUSH VIBURNUM**

Broad suckering shrub to 8 ft. or more. Large rounded leaves. Flat white flower clusters surrounded by conspicuous sterile florets in early spring. Berries red, finally black. Useful in moist parts of a northern woodland garden. GA.

Viburnum cassinoides (2)**WITHE-ROD VIBURNUM**

Shrub to 6 ft. with clusters of white flowers in late May. Berries changing from yellow to red and black. Good in a naturalized garden. As with other shrubs, best fruit production is likely to occur when several plants of the same species are planted together. DU, GA, LC, PF, SH, WN, 21, 2S.

Viburnum dentatum (3-2B)**ARROW-WOOD VIBURNUM**

Leggy shrub to 10 ft. or more. Glossy roughly cut leaves. Conspicuous flat clusters of white flowers in late May. Blue-black berries in autumn. Shade-tolerant. DU, FE, LI, LN, LT, MK, ML, PF, RO, RS, SH, SQ, WB, 1, 5, 6, 9, 10, 15, 21, 2S, 31.*

Viburnum dilatatum (5)**LINDEN VIBURNUM**

Dense shrub to 5-6 ft. Notable for its clusters of red berries that last into winter. One of the most fruitful viburnums, but rather variable. BR, CB, DU, LI, ML, PF, RO, SH, WN, 1, 3, 5, 9, 10, 15, 21, 2S, 36, 41.

Viburnum ichangense (6)

ICHANG VIBURNUM

Shrub to 5 ft. with bright red berries in clusters along the branches. BR, DA, 22, 36.

Viburnum japonicum (7)

Evergreen shrub to about 5 ft. Glossy dark green leaves sometimes 6-in. long. Fragrant white flowers in spring. Bright red berries. BH, PT, 30, 43, 44, 46.

Viburnum lantana (4-3B)

WAYFARING-TREE

Tall open shrub with somewhat coarse foliage. Clusters of white flowers in early May. Berries change from red to black. BA, DE, DU, ED, KS, LC, LI, MB, ML, PF, RO, SH, 5, 10, 16, 21, 28, 31, 32.

Viburnum lentago (3-2B)

NANNY-BERRY

Vigorous tall spreading shrub with clusters of white flowers in mid-May. Berries change from red to black in autumn. Useful in a naturalized area. BA, DE, DU, GI, KS, LC, ML, PF, SH, 5, 7, 10, 15, 16, 21, 28, 31, 34.

Viburnum opulus (3)

EUROPEAN CRANBERRY-BUSH

Stout open-growing viburnum to 8 ft. or more. Flat clusters of small white fertile flowers surrounded by conspicuous sterile florets, mid-May. Red berries often retained late in the season. Plant lice frequently disfigure the leaves of this species. GI, GU, KE, ML, NE, PF, RO, SH, 1, 28, 31, 41. *Selected Forms:*

'**Compactum.**' Dense, to 5 ft. or more. A fruiting form, not to be confused with 'Nanum' (See page 75). BA, CB, DU, LN, SH, WG, 5, 17.

'**Xanthocarpum.**' Berries yellow. FO, LC, LN, WG, 5.

Viburnum prunifolium (4)

BLACK-HAW VIBURNUM

Shrub to 10-12 ft. or small rounded tree. Small leathery leaves with deep purple or red autumn color. Berries turn from yellow to black. One of the best tall viburnums. DU, GI, HY, LI, PF, PW, RO, SH, SQ, WN, 5, 9, 15, 21, 28, 36, 38.

Viburnum rhytidophylloides 'Willowwood' (*lantana* × *rhytidophyllum*) (5)

Large dense shrub with rough, long leaves held late in autumn. Flat clusters of white flowers in spring, again in autumn. 11, 25, 44.

Viburnum rhytidophyllum (6-5B)

LEATHER-LEAF VIBURNUM

Broad dense evergreen shrub to 6 ft. or

more. Long rough leaves. White flower clusters in late spring. Foliage retained in best condition Philadelphia southwards. CB, DA, EA, ED, FO, GE, LA, ML, PF, RK, RO, SQ, WB, 1, 9, 20, 21, 22, 25, 28, 33, 38, 41, 42.

Viburnum setigerum (*theiferum*) (5)

TEA VIBURNUM

Long-stemmed shrub to 8 ft. or more. Profuse red berries in autumn. DA, DU, EA, FO, GE, HY, LI, ML, PF, RK, RO, WG, 1, 9, 21, 28, 36, 38, 41. *Selected Form:* '**Aurantiacum.**' Orange berries. 34, 36.

Viburnum tinus (8-7)

LAURESTINE

Dense evergreen shrub to 10 ft. or more. Glossy dark green leaves. Pinkish-white flowers in late winter or early spring. Makes a handsome hedge. ED, SI, 23. *Selected Forms:*

'**Nanum.**' To about 4 ft. 33, 44.

'**Robustum.**' BH, PT, 30, 33, 42, 43, 44, 46.

Viburnum trilobum (*americanum*) (3-2B)

AMERICAN HIGHBUSH-CRANBERRY

Sometimes considered a botanical variety of *V. opulus*, which it closely resembles. Fruits edible. Useful in a wild-life planting. BU, DU, FA, KR, LN, PF, PW, RO, SQ, ZI, 5, 6, 9, 15, 16, 21, 28, 32.

Viburnum wrightii (5)

WRIGHT VIBURNUM

Rather refined shrub to 6 ft. or more. Numerous red berries in autumn. A form of *V. dilatatum* with very pubescent leaves is sometimes sold as *V. wrightii*, but the latter species has nearly glabrous leaves. CB, DU, EA, KE, LA, LC, LI, ML, NE, RO, SQ, WG, 5, 10, 15, 21, 34, 36. *Selected Form:* '**Hessei.**' To 4 ft. KI.

For other *Viburnum* see page 52 and 75.

Weigela**Weigela** 'Foliis Purpureis' ('Java Red,' 'Purpurea') (5)

PURPLE-LEAF WEIGELA

Shrub to 4 ft. with dull purplish-green leaves. Pink flowers in spring. BA, ED, FO, GD, MB, SH, SI, 1, 6, 44, 45.

Weigela 'Nana Variegata' (5)

To about 3 ft. Variegated foliage. Needs little pruning. CO, MB, SI, TE, WN, 1, 11, 21, 28, 31.

Weigela 'Variegata' (5)

To about 4 ft. Golden variegated leaves. Flowers deep rose. BA, GI, KE, SH, SR, 30, 32.

For other *Weigela* see page 53.

DWARF OR LOW-GROWING SHRUBS

Deciduous and Broadleaf-evergreen

Deciduous unless otherwise noted

Abelia

Abelia 'Edward Goucher, (grandiflora × schumannii) (7-6B)

Mounded shrub to 2-3 ft. Small trumpet-shaped flowers in summer. Magenta. Leaves retained late in autumn in New York. BH, EA, ED, GE, HA, ML, PT, SI, 11, 14, 20, 23, 26, 30, 33, 42, 43, 44, 46.

Abelia grandiflora (chinensis × uniflora) (6-5B)

GLOSSY ABELIA

Mounded shrub to 3-4 ft. in the North, twice that in the South. Refined small leaves retained late into autumn. Attractive, although not showy, white-to-pink flowers through summer. Has the longest flowering season of any shrub hardy in New York. CB, EA, GE, HA, HY, ML, NE, PF, PT, SI, SR, ST, VI, WB, WG, 1, 9, 12, 14, 19, 21, 23, 28, 33, 36, 42, 44. *Selected Forms:*

'Nana' ('Prostrata'). To 2 ft. Nearly prostrate. Ground cover. BH, EA, MD, PR, 44. #U.S.D.A. 210092. Rose-pink flowers. CB, 41.

Abelia schumannii (7)

Mounded shrub to 3-4 ft. with semi-evergreen leaves. Lavender-pink flowers in summer. AL, WB.

Abelia-leaf

Abeliophyllum distichum (5-4B)

Dense shrub to 3-4 ft. with white forsythia-like flowers in early April. Flower buds may be susceptible to late frosts in cold areas. Slow-growing. Sometimes difficult to establish. CB, DA, KI, LE, WF, WG, WN, 36.

Andromeda, Bog-rosemary

Andromeda glaucophylla (2)

DOWNY ANDROMEDA

Shrublet to 6-8 in. with stiff, twiggy stems. Bluish evergreen leaves. Light pink flowers in May. Needs moist, acid soil. AL, MF, VI, WA.

Andromeda polifolia 'Nana' (2)

DWARF BOG-ROSEMARY

Dense mound to 10-12 in. with narrow gray-green evergreen leaves. Attractive

pink flowers in May. AL, KI, MF, ML, OL, PK, RF, SO, ST, VI, WA, 8, 17, 23, 33, 35, 42.

Bear-berry

Arctostaphylos uva-ursi (2)

Dense trailing ground cover to 1 ft. Small dark evergreen leaves. Tiny white flowers in May. Red berries. Needs acid, sandy soil. AL, CB, ED, LE, LT, MF, ML, OL, PA, PF, SI, WA, WI, 3, 6, 8, 19, 21, 23, 33, 42.

Barberry

Berberis buxifolia 'Nana' (6-5B)

DWARF MAGELLAN BARBERRY

Dense evergreen shrub to 18 in. Small leaves. Seldom flowers. Of interest as one of the few woody plants of the Southern Hemisphere hardy in the northern U. S. LI, MF, VI.

Berberis darwinii (7)

DARWIN BARBERRY

Handsome evergreen shrub generally growing to only 3 ft. in the U. S. Leaves small, holly-like, turning purple in autumn. Rather conspicuous orange-to-yellow flowers in early spring. BH, ED, 23, 42.

Berberis stenophylla 'Irwinii' (darwinii × empetrifolia) (5)

ROSEMARY BARBERRY FORM

Spreading low evergreen or semi-evergreen shrub to about 3 ft. in the North, taller in the South. Small slender leaves. Abundant yellow flowers in spring. RF, RI, WA, SI, 23.

Berberis thunbergii 'Crimson Pygmy' ('Atropurpurea Nana') (5-4B)

CRIMSON PYGMY BARBERRY

Handsome compact shrub to 2 ft. with dark red leaves. Broader than tall. Good low hedge. BA, BU, CB, EM, FE, KS, RK, LA, LI, MA, ML, SH, 5, 23, 31, 38, 42, 44.*

Berberis triacanthophora (5)

THREE-SPINE BARBERRY

Handsome evergreen shrub to 3-4 ft. Slender 2-in.-long leaves. BR, LI, MD, 20, 22, 28, 42, 44.

Berberis verruculosa (6-5B)

WARTY BARBERRY

Mounded evergreen shrub to 3-4 ft. Lustreous leaves, white beneath, are 1-in. long.

Most barberries have graceful small yellow flowers in spring, but the flowers of this species are especially nice. BR, CB, DA, EA, ED, MF, PF, RO, SH, SI, WB, WN, 9, 20, 21, 22, 28, 33, 36, 41, 42.

For other barberries see page 54.

Dwarf Birch

Betula nana (2)

Low, spreading, twiggy shrub to 2 ft. Leaves small, often rounded. Deciduous. AL, PK, WA.

Spike-heath

Calluna spiculifolia (5)

Spreading evergreen shrublet to 10–12 in. Pale pink flower spikes in May–June. Heather relative, with the same cultural requirements. MF, PF, RF, WA, WF, 8, 23.

Boxwood

Buxus microphylla 'Compacta' (5)

KINGSVILLE DWARF BOX

Exceptionally dense, slow-growing shrub to about 18 in. Small leaves. Bonsai candidate. EA, MA, RF, RO, SO, VI, WA, 1, 23, 36.

Buxus microphylla *koreana* (4)

KOREAN BOX

Spreading, somewhat loose, evergreen shrub to 1½–2 ft. tall. Winter foliage not as attractive as in *B. sempervirens*. BA, CO, FO, GI, LI, LN, MF, ML, MU, PA, RO, SH, ST, WA, WE, 16, 22, 36, 38, 41, 44. *Selected Form*: 'Wintergreen.' BA, RK, SA, 1, 5, 11, 14, 16, 44. *Other Forms*:

Var. japonica (6–5B). JAPANESE BOX. Compact evergreen shrub to 5 ft. with spreading branches and slightly larger leaves than in the species. BH, DA, EA, GE, PT, RO, WN, 12, 13, 19, 30, 44, 46. *Var. sinica* (*harlandii*) (6). HARLAND OR CHINESE BOX. Handsome shrub to 2 ft. with narrow, closely set leaves. BH, GE, 1, 12, 13, 14, 30, 36.

Buxus sempervirens 'Suffruticosa' (5)

EDGING BOX

Dense small-leaved evergreen shrub to 2–2½ ft. Often used as a miniature clipped hedge or edging plant. DA, EA, ED, GE, GI, LT, MD, MF, ML, PF, RO, WB, 1, 20, 21, 23, 31, 33, 41, 42.

Buxus sempervirens 'Welleri' (5)

COMMON BOX, WELLER FORM

Dense evergreen mound to 4 ft. after many years. Broader than tall at maturity. Foliage attractive through winter. More satisfactory in the North than other forms

of common box. BA, SQ, VI, WF, 6, 10.

For other boxwood see page 55.

Heather

Calluna vulgaris (4)

Valuable small rock garden shrubs with small evergreen leaves and flowers ranging from white to pink and purple. Long flowering period, beginning in July. Although there is only one species, it is highly variable. Usually less than 1 ft. in gardens. Best results in acid soil of modest fertility. Soil should retain moisture but be well-drained. Full sun. Provide loose cover of evergreen boughs for winter protection from Philadelphia northwards. Substantial pruning, if needed, should be restricted to early spring. Many named forms. A few of the better ones:

'Else Frye.' Low, semi-prostrate. Foliage vivid green. Double white flowers. MF, PF, RI, 23, 33, 35.

'Foxii Nana.' Mound to only 4-in. high. Flowers purple. AL, OL, RI, SO, WA, WF, WI, 23, 35.

'H. E. Beale.' Flowering sprays to 18-in. long. Fairly large shell-pink flowers. AL, ED, HY, MF, PF, RI, WF, WG, WN, 23, 33.

'J. H. Hamilton.' Spreading cushion. Bright pink double flowers. AL, MF, PF, RI, WF, WG, 23, 33, 35.

'Juno.' Thick mound of arching stems. 8–12 in. tall. Lavender flowers. MF.

'Mrs. Pat.' Spring growth bright pink. Flowers purple. MF, PF, RI, SO, WF, 23, 33, 35.

'Pygmaea.' Dwarf, forming mats. Excellent foliage. Purple flowers. AL, RI.

'Ronald Gray.' Prostrate. Lavender flowers on lateral spikes. AL, MF, OL, PF, RI, WA, WF, WI, 17, 23, 33, 35.

'Tib.' Thin open mound. Flowers dark purple, double. AL, CB, MF, PF, RI, WF, WI, 6, 23, 33, 36.

'Valorian.' Hybrid of 'R. H. Gray' and 'Foxii Nana.' Handsome slow-growing mat. Deep lavender flowers, rather sparse. MF, WA.

Other Forms: PF, RF, VI, WN, 8.

Bluebeard

Caryopteris clandonensis 'Blue Mist' (*incana* × *mongholica*) (5)

Shrub to 4 ft. with light blue flowers in late summer. Prune back to the ground in early spring. BU, CO, FA, FE, GU, KE, LE, NE, PV, RK, RO, SH, VI, WB, 6,

22, 31, 32. *Other Form*: 'Dark Knight.'
Flowers purple. LE, ML, WN, 1.

Cassiope

Cassiope lycopodioides (2)

Evergreen mat to 6-8 in. Leaves scalelike. A heather relative with white bellshaped flowers in April. Moist, acid soil. MF, WA, WI.

Sweet-fern

Comptonia peregrina (2)

Woody plant, to 3 ft., with aromatic fern-like foliage. Flowers inconspicuous. Good for dry banks. Should be cut back sharply when transplanted. DU, GA, SN, 21.

Dogwood

Cornus florida 'Pygmy' (5?)

DWARF FLOWERING DOGWOOD

Dense low-growing form, perhaps to 4 or 5 ft. Modest white bracts in early or mid-May. KI, 8, 15, 38, 42.

Cornus sericea 'Kelsey' (3)

KELSEY SHRUBBY DOGWOOD

Dense shrub to 2 ft., occasionally used as a rough ground cover. *C. sericea* commonly listed in catalogs as *C. stolonifera*. BA, FO, LC, PF, WI, 1.

Cotoneaster

Cotoneaster adpressa (4-3B)

Prostrate deciduous shrub with rooting stems. Small pink flowers in May. Bright red berries in autumn. GI, SH, SI, WN, 3, 19, 35. *Selected Forms*:

Var. praecox. EARLY COTONEASTER. Dome-shaped to 1½-2 ft. Small dark green leaves turn red before dropping in autumn. Persistent berries. CB, LI, LT, OL, PF, RO, SH, WA, WE, WN, 3, 6, 9, 17, 31, 35, 38, 41, 44. **'Tom Thumb.'** Compact shrublet to 8-10 in., hardly creeping. Small leaves. Red berries. Bonsai. 33, 35, 38.

Cotoneaster apiculata (4)

CRANBERRY COTONEASTER

Deciduous shrub to 3 ft. with horizontally spreading branches. Small shiny deep green leaves. Showy, relatively large berries in autumn. BA, DA, LA, LI, LT, MD, OL, PK, RK, RO, WA, WN, 3, 4, 5, 7, 16, 21, 23, 33, 35, 44, 45.

Cotoneaster congesta (microphylla glacialis) (6)

PYRENEES COTONEASTER

Exceptionally dense mound to 3 ft. Evergreen. Bright red berries in autumn. MF,

OL, PA, PK, RK, RO, VI, WA, WN, 8, 14, 19, 20, 23, 26, 38, 42, 43, 44, 46.

Cotoneaster conspicua 'Decora' (6)

NECKLACE COTONEASTER

Prostrate shrub with handsome small glossy leaves. Evergreen. Small scarlet berries. Ground cover. GE, PT, RO, 26, 44.

Cotoneaster dammeri (4)

BEARBERRY COTONEASTER

Prostrate shrub to 1 ft. with long trailing branches. Leaves evergreen, 1-in. long. Variable. Bright red berries. Ground cover. CB, CO, DA, ED, MF, OL, PA, RO, SH, SI, VI, WA, WN, 8, 17, 19, 28, 31, 36, 42, 44. *Selected Form*: 'Skogsholmen.' Small leaved shrub to 15-in. tall. Vigorously spreading. Profuse white flowers in May. Ground cover or accent plant. Semi-evergreen on Long Island. Choice. CO, DA, ED, OL, RO, SH, SS, WA, WE, 17, 20, 21, 28, 35, 38, 40, 41, 45.

Cotoneaster 'Herbstfeueur' (dammeri > salicifolia) (6)

Prostrate shrub with lustrous, leathery willow-like leaves. Brilliant red autumn color. CB, LA, RO, SS, WA, WG, 28, 35, 41.

Cotoneaster horizontalis (4)

ROCKSPRAY COTONEASTER

Horizontally spreading shrub, 2-3 ft. tall. Branching resembles a fish skeleton. Brilliant orange foliage in autumn. More-or-less evergreen in the South. Red berries. Handsome. DA, GI, HY, LA, LI, ML, OL, SI, VI, WG, WI, WN, 3, 9, 20, 33, 35, 36, 38, 40, 42. ** Selected Forms*:

'Little Gem.' Prostrate, to 6-in. tall. No fruits. MF, PA, WA, WI.

'Variegata.' Leaves edged silver. AL, MI, PA, SP, WG, 23.

Cotoneaster microphylla (6-5B)

SMALL-LEAF COTONEASTER

Dense mound to 2-2½ ft. ½-in. long evergreen leaves. Needs more pruning than other forms to keep a good habit. Scarlet berries. Most of the low-growing cotoneasters are bonsai candidates, but this one especially so because of its small leaves. AL, DE, ED, PK, SI, WB, 14, 23, 31, 34, 42, 46. *Selected Forms*:

'Cooperi.' Trailing, forming a low mound. Slow-growing. MF.

'Thymifolia.' The smallest-leaved cotoneaster. Distinctive, but it does not tolerate the winters of New York City very well. AL, MF, OL, PK, RF, SI, SS, WA, 23, 34, 42, 44.

For other cotoneasters see page 41 and 56.

Broom

Cytisus decumbens (5-4B)

Prostrate broom to 8-in. tall. Bright yellow pea-like flowers in May-June. Makes an interesting ground cover. As with all *Cytisus*, provide full sun and sharp drainage. Sometimes listed under *Genista*. AL, MF, OL, WA, S.

Cytisus kewensis (ardoinii × albus) (6)

KEW BROOM

Mat 6-8 in. high. Very pale yellow flowers in early May. Pea-like. AL, MD, MF, SI, SO, VI, WI, 17, 33, 35, 42.

Cytisus purgans (5)

PROVENCE BROOM

Dense shrub to 2-3 ft. with stiff upright branches. Deep yellow flowers in early May. RO, SII, VI, 33, 35, 42.

Cytisus purpureus (4)

Shrub to 1½ ft. with arching stems and clover-like leaves. Purple flowers in early May. MF, OL, VI, S.

For other *Cytisus* see page 41.

Irish-heath

Daboecia cantabrica (5)

Dense shrub to 1-1½ ft. Evergreen. Tiny purple bell-shaped flowers through much of the summer. Heath relative. AL, PF, RA, RI, WA, WI, S.

Daphne

Daphne blagayana (6-5B)

Semi-prostrate evergreen shrub to 8-in. high. Creamy-white flowers in early spring. Fragrant. AL, WI.

Daphne burkwoodii 'Somerset' (*caucasica* × *cnereum*) (4-3B)

Rounded shrub to about 4 ft. Semi-evergreen in the North. Fragrant whitish-pink flowers in mid-spring. Somewhat broader than tall. More vigorous and less temperamental than other daphnes. CB, CO, KI, ML, RO, SH, SR, WF, WG, WN, 42.

Daphne cnereum (3)

ROSE DAPHNE

Grayish evergreen mound to about 10-in. high. Covered with small bright pink flowers in early May. Fragrant. Sometimes short-lived. AL, BA, CB, CO, ED, LT, MF, ML, RO, SH, SO, VI, WF, WG, WI, ZI, 1, 3, 6, 8, 23, 42. *Selected Form*: 'Ruby Glow.' Foliage green. Flowers deep pink. SI, SO, VI, 23.

Daphne collina (7-6B)

Dense evergreen shrub to 2-2½ ft. Dark

green leaves. Fragrant rose-purple flowers in June. AL.

Daphne genkwa (6-5B)

LILAC DAPHNE

Upright shrub to 3 ft. with scentless lilac-colored flowers. April. WG, 22, 41.

Daphne mezereum (4-3B)

FEBRUARY DAPHNE

Upright shrub to 3 ft. with clusters of lilac-purple flowers in very early spring. Attractive but toxic red berries. Since it is rather difficult to transplant, best obtain container-grown plant. Not always easy to establish. BR, VI, WN, 42. *Selected Form*: 'Alba.' White flowers followed by yellow fruits. AH, BR.

Daphne odora (7)

Evergreen shrub to about 4 ft. Intensely fragrant rose-purple flowers in late winter or very early spring. CB, WA, 4, 23, 46. *Selected Form*: 'Marginata.' Leaves bordered white. PT, 4, 23, 42.

Daphne retusa (6-5B)

Dense evergreen shrub to 2-2½ ft. Shiny green leaves. Fragrant white flowers tinged rose. Late April or early May. AL, SO, 42.

Bush-honeysuckle

Diervilla lonicera (trifida) (3)

NORTHERN BUSH-HONEYSUCKLE

Open shrub to 3 ft. with lustrous green leaves. Small greenish-yellow funnel-shaped flowers in June. Useful for bank plantings or for a moderately shady spot. FO, SN.

Diervilla sessilifolia (4)

SOUTHERN BUSH-HONEYSUCKLE

Suckering shrub to 4 ft. tall. Shiny foliage most effective in late spring. Rather attractive, small, deep yellow flowers in June. Bank cover. GA, 21, 28.

Elsholtzia

Elsholtzia stauntonii (4)

Mint-family shrub to 4 ft. Lilac-purple flower spikes in late summer. While the wood is fully hardy on Long Island, the shrub may be treated as a die-back in colder areas. BR, LE, RO, VI.

Trailing-Arbutus

Epigaea repens (3)

Evergreen shrublet with trailing stems. Clusters of sweetly scented pink-to-white flowers in early April. Difficult to establish. Purchase pot-grown plants from commercial nurseries and set out in acid, humus-rich soil. MF, WA, WI, WN.

Heath

Erica species and forms

A very large genus of evergreen shrubs. Culture same as for heather.

E. carnea (5)

Usually 8-12 in. tall in the rock garden. The many forms are valued for their long flowering season, beginning in winter and continuing into spring. Flowers, like those of heather, are small and bell-shaped. *Selected Forms:*

'King George.' Crimson flowers. Sporadic bloom from December to early April in New York City. One of the best. AL, ED, MF, ML, OL, PF, PR, RI, RK, 23, 33, 42.

'Ruby Glow.' Decumbent mound. Flowers ruby-red. AL, MF, ML, PF, WI, 33.

'Springwood Pink.' Fast-growing mat to 8 in. high. Deep pink flowers. MF, PF, WF, WG, 23, 33, 36, 42.

'Springwood White.' AL, CB, ED, LE, MF, PF, PR, RI, WA, WG, WI, 17, 23, 33, 42.

'Vivellii.' Reddish-green foliage. Tight grower. Dark red flowers. AL, ED, LE, MF, PF, WA, WF, WG, 23, 33, 36.

Erica cinerea forms:

'C. D. Eason' (5). To 6 in. Bright red flowers in summer. ED, RI, WF, 23.

'Golden Drop' (6). Tufted mound to 4-6 in. Yellow foliage, red in winter. Pinkish-

lilac flowers in late spring and early summer. ED, PF, RI, WA, WI, 23.

Erica tetralix 'Con Underwood' (3)

Gray-green foliage. Thin decumbent branches. To 9 in. Crimson flowers throughout much of the summer. AL, PF, 23.

Erica vagans (5) forms:

'Mrs. D. F. Maxwell.' Flowers cherry-red, summer. Upright, to 1 ft. AL, ED, ML, PF, RI, WF, WI, 23, 33, 42, 44, 46.

'Nana.' To 6 in. White flowers. Summer. WI, 23, 33.

Euonymus

Euonymus fortunei 'Carrieri' (5)

GLOSSY WINTER CREEPER

Loose evergreen shrub to 4 ft. with shiny dark green leaves. Climbing habit if supported. Fruit resembles bittersweet. LI, LT, SH, SQ, WN, 10, 30, 44.

Euonymus fortunei 'Coloratus' (4)

Trailing shrub to 1½-2 ft. high. Foliage retained through the year, turns purple in winter. Ground cover. BA, ED, EM, GE, GI, HE, KS, LI, NE, PF, RO, SH, SI, 1, 6, 16, 28, 31, 32, 36, 44.

Euonymus fortunei radicans (5-4B)

WINTER CREEPER EUONYMUS

Trailing or climbing evergreen shrub with shiny dark green leaves. Of interest as th



Marjorie J. D.

Male form of skimmia (*Skimmia japonica*) in late winter showing the clustered flower buds which open in early spring. Although not showy, flowers are very fragrant.

hardest evergreen vine. Often listed simply as *Euonymus radicans*. Ground cover. ED, FE, FO, HY, LI, PF, PT, PY, 6, 20, 25, 28, 33, 42.

***Euonymus fortunei* 'Sarcocoe' (5)**

Upright shrub to 4 ft. with glossy green leaves. Retains its foliage over winter in better condition in northern areas than the species. CO, EM, GI, HA, KR, KS, LN, MB, ML, RO, SH, ST, WE, WF, 1, 5, 16, 19, 21, 25, 30, 38, 44, 45.

***Euonymus fortunei* 'Vegetus' (5-4B)**

BIG-LEAF WINTER CREEPER, EVERGREEN BITTERSWEET

Spreading evergreen shrub to 4 ft. Dull green leaves. Profuse bittersweet-like fruit persists far into winter. Semi-evergreen in colder parts of the North. AH, CO, GI, KE, LA, LN, LT, ML, SH, SQ, ST, VI, WN, 1, 5, 7, 16, 28, 31. *Other Forms:*

Emerald Series available from SH, 6.

***Euonymus nanus* 'Turkestanicus' ('Koopmannii') (4-3B)**

FERN-LEAF EUONYMUS

Distinctive upright shrub to about 4 ft.; 3-in.-long linear leaves. Evergreen in a mild winter in New York City; semi-evergreen northward. BA, VA, 1.

For other euonymus see page 56.

Forsythia

***Forsythia* 'Arnold Dwarf' (5)**

Shrub to 3-4 ft. Best kept to 1 ft. Given an occasional trimming, it makes a handsome bank cover. Refined foliage. Flowers sparsely. CB, GI, HE, LC, LT, MK, PF, SH, VI, 3, 5, 31, 35, 38.

***Forsythia viridissima* 'Bronxensis' (5)**

BRONX FORSYTHIA

Shrub to 1 ft. high, twice as broad. Leaves small. Numerous small yellow flowers in early April. Not a good ground cover since it is shy to root. FE, HE, IN, KI, LI, MF, MK, PA, SA, SO, VI, WI, 5, 9, 21, 35, 36, 44.

Fuchsia

***Fuchsia procumbens* (7)**

Trailing shrublet to 3-in. high. Flowers blue and yellow, summer. Red berries. AL, WI. Other dwarf fuchsias, AL.

Wintergreen

***Gaultheria adenothrix* (7-6B)**

Trailing or creeping shrublet to 8-9 in. high. Pinkish-white flowers in June followed by red berries. Evergreen. AL.

***Gaultheria nummularioides* (7-6B)**

Trailing evergreen shrublet to 4-in. high. Tiny leaves. Blue-black berries. RA, RI, SO, 23.

***Gaultheria procumbens* (3)**

EASTERN WINTERGREEN

Creeping evergreen ground cover to 3-4 in. high. Tiny white bell-shaped flowers in early May. Red berries. Aromatic. Suitable as a small ground cover in the woodland garden. Popular terrarium plant. OL, RA, SN, WA, 8, 17, 42.

***Gaultheria wisleyensis* (6)**, a low-growing bigeneric hybrid with handsome evergreen foliage, is available from SO, WA.

Huckleberry

***Gaylussacia brachycera* (6)**

BOX HUCKLEBERRY

Spreading evergreen shrub to 1 ft. high. Small shiny green leaves. Ground cover. Acid soil. Handsome. MF, WA, 8.

Genista

***Genista germanica* (5)**

Flat-topped shrub to 1 ft. Spiny. Bright yellow pea-like flowers in late May or early June. *Genista* is closely related to *Cytisus* (broom). They require rather poor sandy soil and sharp drainage to thrive. MF, OL, WA, WI, 8.

***Genista lydia* (*hispanica lydia*) (7)**

Rock-garden shrub to 2 ft. Bright yellow flowers in late May or early June. Rather showy. OL, WI, 8, 17, 23, 33.

***Genista pilosa* (*prostrata*) (5-4B)**

Prostrate shrub to 1 ft. high. Yellow flowers in mid-May. AL, LE, MF, OL, SO, WA, WI, 8.

***Genista sagittalis* (4-3B)**

Completely prostrate. Yellow flowers borne on upright stems. Rather fast-growing. AL, LE, MF, OL, SO, WI, 8.

***Genista villarsii* (5)**

Shrublet to 6 in. Stems grayish-green. Bright yellow flowers in late spring. AL, SO, WA, WI.

Shrub-veronica

***Hebe cupressoides* 'Nana' (7)**

Globe-shaped evergreen shrub to about 1 ft. Pale blue flowers in late spring or early summer. *Hebe* is often placed under *Veronica* in catalogs. Provide dry sandy soil. AL, RF, WI, 23.

***Hebe decumbens* (7)**

Compact evergreen shrub to about 15 in.

Gray-green leaves with red margins. White flowers on short spikes. May. MF, WA.

Hebe hectori (7)

Evergreen shrub to 2-2½ ft. Glossy light green leaves. Flowers white or pinkish. RF, WI.

English Ivy

Hedera helix 'Conglomerata' (6)

BUNCH-LEAF IVY

Distinctive shrubby form to 1-1½ ft. Small, closely set, two-ranked leaves on stiffly upright stems. CB, MF, ML, WA, WI, 22, 23, 33, 36.

St. Johnswort

Hypericum calycinum (6)

AARONSBEARD HYPERICUM

Creeping shrub to 1 ft. high. Evergreen in the South. Yellow flowers over a long period in summer. Tolerates some shade, providing soil is sandy. Ground cover. CB, ED, KR, ML, PR, PT, PY, SI, WG, WI, 33, 42, 43, 46.

Hypericum kalmianum (4)

Shrub to 3 ft. Bluish-green leaves. Bright yellow flowers, 1-in. across, appear in early summer. BR, CO, FE, GU, IN, LI, SR, 5, 31, 32.

Hypericum moserianum (patulum × calycinum) (6-5B)

GOLD-FLOWER

Low shrub or loose ground cover with 2-2½ in.-wide yellow flowers over a long period in summer. Refined foliage. BH, HA, PT, 30, 43, 46.

Hypericum patulum henryi (6-5B)

HENRY ST. JOHN SWORT

Half-evergreen shrub to 2-3 ft. Spreading. 2-in.-wide golden yellow flowers in summer. LE, LI, PT, 30, 46.

Hypericum patulum 'Hidcote' (5)

Rounded shrub to 18 in. Yellow flowers most of the summer. Often herbaceous in the North. DA, EM, GE, KE, KR, LE, LI, ML, WF, WG, 5, 6, 28. *Other Form: 'Sungold.'* Similar to 'Hidcote' but reputedly a bit harder. BU, IN, ST, WG, 43.

Hypericum prolificum (4)

SHRUBBY ST. JOHN SWORT

Dense shrub to 3-4 ft. Fairly small bright yellow flowers in July. Shiny brown stems have winter character. DU, GA.

Japanese Holly

Ilex crenata 'Green Cushion' (6-5B)

Tight mound to 1 ft. or more. Glossy small

evergreen leaves. Bonsai candidate. VI, WA, 36, 42.

Ilex crenata 'Helleri' (6-5B)

HELLER JAPANESE HOLLY

Very slow-growing, compact evergreen shrub to 3-3½ ft. Cushion-like. Small glossy dark green leaves. One of the best. Bonsai. CB, EA, HA, MF, NE, OL, RO, SI, VI, WA, WB, WI, WN, 8, 9, 15, 19, 23, 28, 38, 42, 44.*

Ilex crenata 'Hetzii' (5)

HETZ JAPANESE HOLLY

Spreading low evergreen shrub to about 2½ ft. high. The convex leaves are fairly large for a Japanese holly. CB, DA, ED, GE, GI, LI, LT, MU, NE, PK, RK, RO, WO, 2, 6, 10, 15, 19, 28, 31, 35.*

Ilex crenata 'Mariesii' ('Nummularia') (6)

Very slow-growing upright evergreen shrub to about 3 ft. Picturesque short stiff branches. Small rounded coin-like leaves. Bonsai. PK, RF, WA.

Ilex crenata 'Stokes' ('Stokes Dwarf') (5?)

Similar to 'Helleri,' but slightly flatter in growth. Reportedly a bit harder. Bonsai. BT, LI, LT, PF, VI, 10, 12, 22, 25, 38, 45. *For other hollies see page 30 and 57.*

Kalmia (Laurel)

Kalmia angustifolia (2)

SHEEP LAUREL

Evergreen shrub to 3 ft. Clusters of rose-red flowers in early June. Requires moist, acid soil. AL, OL, WA, 8.

Kalmia polifolia microphylla (3)

Semi-prostrate evergreen shrub to 1 ft. Narrow leaves. Conspicuous lavender flowers in May or June. Requires moist, acid soil. AL, SO, WA, WI.

Kalmiopsis

Kalmiopsis leachiana (6-5B)

Shrub to 1 ft. with small evergreen leaves. Rosy-purple flowers in late May or early June. Full sun. Moist, peaty soil. SO. *Named Form: 'Le Piniec.'* WA.

Lavender

Lavandula officinalis 'Compacta Nana' (5)

Dense evergreen shrublet to 8-10 in. Narrow aromatic leaves. Silvery. Flowering in early summer. AL, WA.

Labrador Tea

Ledum groenlandicum (2)

Evergreen shrub to 3 ft. Leaves wooll beneath. White flowers in late April. Suit

able for a very moist or boggy site in acid, peaty soil. PK, WI.

Sand-myrtle

Leucophyllum buxifolium (5)

Evergreen shrub to 1½ ft. Tiny leaves. Small white flowers in early May. BR, GA, ML, 8, 36. *Selected Forms*:

'Nanum.' To 10 in. More-or-less prostrate. AL, WA.

'Prostratum.' Completely prostrate. RF, WA.

Leucothoe

Leucothoe axillaris (6)

COAST LEUCOTHOE

Evergreen shrub to 2 ft. with arching stems and dark green leaves. Small white bell-shaped flowers in racemes. Late May. Provide acid soil for all leucothoes. Shade tolerant. HY, MD, OL, PF, RO, SO, WA, 8, 9, 23, 28, 33, 35, 36, 38, 44.

Leucothoe fontanesiana (catesbei) (5-4B)

DROOPING LEUCOTHOE

Evergreen shrub to 3-4 ft. Six-in.-long shiny leaves. Numerous but inconspicuous white heather-like flowers in late May. Foliage turns bronze in cold weather. AH, AL, CB, DA, EA, ED, GA, GI, HY, LA, LT, VI, 1, 7, 9, 10, 14, 15, 19, 28, 35, 38. *Selected Form*: 'Girard's Rainbow.' Leaves colored green, pink and cream. Not as arching in habit as the species. CB, GI, HY, LI, MD, ML, PF, PR, RO, SI, VI, WA, 6, 14, 21, 23, 35, 38, 44, 45.

Leucothoe keiskei (5)

Graceful shrub to 3-4 ft. Three-in.-long leathery evergreen leaves. White flowers in mid-May. AL, VI, WA.

Privet

Ligustrum obtusifolium 'Regelianum' (5)

REGEL PRIVET

Mounded shrub to 4-5 ft. with notably horizontal branching. It is not always easy to obtain the true form in the trade. Handsome. FE, LA, LC, LI, LN, LT, MK, RO, SH, SQ, WG, 5, 9, 20, 21, 28, 32.

Ligustrum 'Suwanee River' (7)

Compact evergreen shrub to about 4 ft. Thought to be a hybrid of *L. japonicum* 'Rotundifolium' and *L. lucidum*. 44.

Ligustrum vicaryi (ovalifolium 'Aureum' × *vulgare*) (5)

VICARY GOLDEN PRIVET

Slow-growing shrub to 4-5 ft. with golden-yellow foliage through the summer. Full

sun. CO, EM, FE, GI, IN, KE, MB, ML, MU, NE, SH, SR, ST, ZI, 5, 11, 16, 21, 28, 31, 36, 44, 45.

Ligustrum vulgare 'Lodense' ('Nanum') (4)

Dense mound to 4 ft. Suitable as a low deciduous hedge. No trimming necessary. Attractive. CO, KS, LC, LI, LN, PV, SH, 30, 32.

For other privet see page 58.

Alpine-azalea

Loiseleuria procumbens

Evergreen shrublet to 6-8 in. with small leaves. Small pink flowers in early summer. Moist, acid soil. AL.

Honeysuckle

Lonicera nitida (7-6B)

BOX HONEYSUCKLE

Handsome evergreen shrub to about 4 ft. Small glossy leaves. Sometimes used as a low hedge in the South. 20, 26.

Lonicera pileata (6-5B)

PRIVET HONEYSUCKLE

Horizontally branched shrub of small to medium size, evergreen in the South. Dense. Small shiny green leaves, refined for a honeysuckle. Amethyst-violet berries. EA, 1, 20, 33.

Lonicera xylosteum 'Clavey's Dwarf' (4)

Shrub to 3-4 ft., used occasionally for a quick low hedge in cold climates. Inconspicuous white flowers. CO, FA, FE, GU, LN, MB, ML, PV, RS, SH, WN, 3, 10, 31. For other honeysuckles see page 44, 58.

Mahoberberis

Mahoberberis aquicandidula (*Mahonia aquifolium* × *Berberis candidula*) (5)

Fine-textured evergreen shrub to about 4 ft. with small spiny, holly-like leaves. Sparsely branched. Benefits from a sharp pruning in early spring. Shade required. Other similar crosses have occurred, but this hybrid seems the most ornamental because of its small foliage. WN, 33.

Mahonia

Mahonia aquifolium (5)

OREGON-GRAPE

Rather open-growing evergreen shrub to 3-4 ft. Shiny leaves resemble those of English holly. Small bright yellow flower spikes in late April and bluish-black berries in fall. Purple autumn foliage. Needs winter shade in the North. Very variable. BU, CB, CO, ED, EM, HA, KS, ML, PF, PT, RI,

RK, RO, SI, VI, WE, WG, 5, 15, 19, 21, 23, 2S, 30, 33, 41, 42, 44. *Selected Form:* 'Compacta.' Dense. To 2-3 ft. LI, PT, RI, RO, SI, VI, 33, 42, 43, 44, 46.

Mahonia nervosa (5)

Mounded evergreen shrub to 2 ft. Shiny leaves. Large clusters of blue-black berries in autumn. BR, MA, RI, SI, WI, 33, 42. *For other Mahonia see page 59.*

Osmarea

Osmarea burkwoodii (6)

Slow-growing mound to about 3 ft. Lustrous small evergreen leaves. Fragrant white flowers in late April. A bigeneric hybrid (*Phillyrea vilmoriniana* × *Siphosmanthus delavayi*). AL.

Pachistima

Pachistima canbyi (4)

Evergreen shrublet to 1 ft. with small narrow leaves. Foliage bronze in cold weather. Flowers inconspicuous. Tolerant of some shade. This eunymus relative makes a fine ground cover or very low border or edging for shrub groupings in areas where scale insects are not troublesome. BA, EM, FO KR, LE, LI, MF, ML, OL, SH, SO, VI, WG, WN, 1, 6, 8, 16, 19, 22, 33, 45.

Tree Peony

Paenonia suffruticosa (5-4B, with protection)

Open-growing shrub to 4-5 ft. Flowers large, white to pink and red; single or double. Many named forms. WF; also from Louis Smirnow, 85 Linden Lane, Glen Head P.O., Brookville, New York 11545.

Pernettya

Pernettya mucronata 'Coral' (7-6B)

Dense evergreen to 2-3 ft. Bright red berries retained all winter. For best fruiting, plant other forms as well. SI, SO, WA, 23, 33.

Pernettya prostrata (nana) (7)

Prostrate evergreen shrublet to 3-4 in. Berries purplish-pink. RF, 23.

Perovskia

Perovskia abrotanoides (5-4B)

Shrub to 4 ft. with slender spikes of blue flowers in late summer. Deeply cut, grayish-green aromatic foliage. Most effective in groups or in the herbaceous border and treated as a die-back shrub. The plant listed in the trade as *P. atriplicifolia* is this species. CB, WG, WN.

Pieris

Pieris floribunda (4)

MOUNTAIN PIERIS

Handsome evergreen shrub usually growing to only 4-5 ft. in northern gardens. More-or-less upright clusters of white flowers in April. It is subject to lacewing infestation unless grown in shade or partially shady areas. BL, GA, HY, LA, LT, PF, RO, VI, WA, WN, 1, 7, 15, 17, 35, 38, 40.

Pieris 'Forest Flame' (forrestii × japonica) (7-6B)

Evergreen. New growth bright red. BR, KI, WA, 23, 36.

Pieris japonica 'Compacta' (5)

Evergreen shrub to about 4 ft. Leaves smaller than in *P. japonica* (see page 45). CB, MD, RO, VI, WA, WN, 21, 23, 35, 38.

Pieris japonica 'Dorothy Wyckoff' (5B?)

Superb deep purple-green winter foliage if grown in full sun. Flower buds pink. Choice. OL, WA, 36, 38, 45.

Pieris japonica 'Pygmaea' (5B?)

Evergreen shrub to 2 ft. Leaves needle-like. AL, KI, RF, SO, VI, WA, 1, 23, 38.

Pieris japonica 'Variegata' (5B?)

Evergreen leaves have narrow white edges. Very slow-growing to about 2 ft. AL, CB, GI, KI, MD, MF, OL, RF, WA, 22, 23, 35, 38, 42.

Potentilla, Bush-cinquefoil

Potentilla fruticosa (2)

BUSH-CINQUEFOIL

Usually a mounded shrub to 3-3½ ft. Small leaves. Yellow flowers in late spring with occasional bloom through summer. Many forms, most with only slight differences. *Selected Forms:*

'Beesiana.' To 18 in. Silvery green leaves. Flowers golden, large. AL.

'Farreri' ('Gold Drop'). Deep yellow flowers. Small leaves. BA, CO, HY, KS, RO, SH, VI, WG, 3, 5, 23, 31, 32.

'Jackman's Variety.' Bright yellow flowers, rather large. BA, CB, CO, FE, GU, IN, KS, RK, RO, RS, SR, WG, 6, 16, 31, 32, 36.

'Katherine Dykes.' Primrose-yellow. BA, KS, LC, PV, RO, WF, WG, WN, 3, 6, 32, 36.

'Maanely's' ('Moonlight'). Pale yellow. ED, EM, RK, SH, VI, WN, 23, 32, 36, 44.

'Mount Everest.' White flowers. Vigorous. BA, LN, 3.

'Tangerine.' Flowers orange, if grown in part shade. CO, DE, SH, WE, 32.

'Veitchii.' White. Compact. CO.

Flowering Almond

Prunus glandulosa 'Albiplena' (5)

DWARF WHITE FLOWERING ALMOND

Shrub to 3-4 ft. Attractive double white flowers in late April. FO, GD, HY, IN, LT, PT, WN, 28, 42.

Prunus glandulosa 'Sinensis' (5)

DWARF PINK FLOWERING ALMOND

Shrub to 3-4 ft. Profuse double light-pink flowers, especially attractive in bud. Late April. FE, FO, GU, IN, KE, KR, PT, RO, SH, SR, ST, WB, 1, 3, 5, 9, 16, 28, 31, 32, 41, 42.

Prunus tenella 'Fire Hill' (3)

DWARF RUSSIAN ALMOND

To 3-4 ft. Profuse red flowers in early May. BA, WG.

Azalea

Rhododendron 'Gumpo' ('White Gumpo') (6)

Dwarf compact evergreen shrub with exceptionally large white flowers in late spring or early summer. CB, HA, NU, OL, PF, RA, RO, WA, 11, 17, 20, 36, 42.

Rhododendron indicum 'Balsaminaeflorum' (6B)

Dwarf evergreen shrub to 1½-2 ft. Double salmon-pink flowers in June. Needs shade from direct sun to preserve color. MF, OL, RH, SP, VI.

Rhododendron indicum 'Flame Creeper' (6B)

Low-growing, semi-prostrate evergreen shrub with orange-red flowers in late May. MF, RA, WA, 33.

Rhododendron kiusianum (obtusum japonicum) (6B)

Dense, semi-prostrate evergreen shrub to about 1 ft., spreading to 3 ft. Lavender-pink flowers in late April or early May. AL, MF, OL, PK, RA, SP, VI, WA.

Rhododendron 'Pink Gumpo' (6)

Similar to 'Gumpo,' but with pink flowers. CB, NU, OL, RA, RO, WA, 17, 36, 42.

For other azaleas see page 46.

Rhododendron

Rhododendron 'Anna Baldsiefen' (5B?)

Compact shrub to 1½ ft. or more. Small evergreen leaves with many vivid light-rose flowers in late April or early May. BL, OL, WA.

Rhododendron 'Bow Bells' (williamsianum hybrid) (5)

Dense shrub to 3 ft. with light evergreen leaves. Large bell-shaped pink flowers in late April or early May. AL, RA, SP, WA, 23, 33, 37, 42.

Rhododendron 'Elizabeth' (repens × griersonianum) (6)

Dense semi-prostrate shrub to about 3 ft.

Large evergreen leaves. Large dark red flowers in April. AM, CM, RA, 17, 23, 33, 37, 42.

Rhododendron ferrugineum (4B)

ALPEN-ROSE

Rounded shrub, eventually to 3-4 ft., that is prized mostly for its rather small evergreen leaves, rusty beneath. Rosy lilac flowers of modest size in June or July. Thrives in cool climates. RA, VI.

Rhododendron impeditum (4B)

Compact mound to 15-18 in. Scaly evergreen leaves ½-in. long, ¼-in. wide. Flowers purplish-blue to lavender-pink. April. BR, CB, CM, ID, MF, OL, RA, RO, SP, WA, 8, 17, 21, 23, 35, 37, 38, 42.

Rhododendron keiskei (dwarf form) (5)

Compact low evergreen shrub with small leaves. Lemon yellow flowers in mid-April. OL, RA.

Rhododendron P. J. M. Hybrids (carolinianum × dauricum) (5)

Tight mound to 4 ft. or more with small evergreen leaves which become purplish-bronze in winter. Lavender-pink flowers in early or mid-April. Slight variations in flower color and habit may be expected. BL, CM, ID, KI, MD, MF, OL, PF, RA, RO, SE, SH, WA, WN, 21, 35, 37, 38.

Rhododendron racemosum (5)

Dense shrub to 18 in. or more. Small evergreen leaves. Pinkish-white flowers in early May. BL, CM, ID, MF, ML, OL, PF, RA, RO, SP, WA, 1, 33, 36.

Rhododendron radicans (5B)

Prostrate evergreen shrublet to 6 in. high. Leaves bright green. Comparatively large purple flowers in May. AL, RA, WA.

Rhododendron 'Ramapo' (4)

Compact evergreen mound to 2 ft. or more. Small, light blue-green foliage. Pale violet flowers in late April or early May. BL, CO, ID, MF, OL, PF, PK, RA, SE, VI, WA, 37, 40, 42.

Rhododendron rupicola (6?)

Evergreen cushion to about 15 in. high. Dark violet-purple flowers in May. Native to limestone cliffs in Yunnan. ID, MF, ML.

Rhododendron williamsianum (5)

Evergreen shrub to 2 ft. or more. Spreading. Fairly small coin-like leaves, tinged bronze. Large shell-pink flowers in April. AL, CM, RA, SP, WA, 33.

Rhododendron yakusimanum (4?)

Dome-shaped shrub to about 2½ ft. Ever-

green leaves with conspicuous indumentum. Pink flower cluster, turning white. May. BL, CM, ID, RA, WA.
For other rhododendrons see page 46.

Jetbead

Rhodotypos scandens (kerrioides) (5)

Shrub to about 4 ft; 2-in.-wide white rose-like flowers in early May, briefly retained. Shiny black fruit usually lasts well into winter, and birds will eat it when other fruits are scarce. Not a first-rate shrub, but useful in a wild-life planting. DU, FE, FO, HE, LC, LN, MK, PF, RO, 5, 9, 21, 28, 31, 41.

Sumac

Rhus aromatica (canadensis) (3)

FRAGRANT SUMAC

Vigorous prostrate shrub to 3 ft., several times broader than tall at maturity. Yellowish flowers in late April. Orange-yellow autumn color. Bank cover. BA, DU, FO, KR, LN, RO, RS, SH, 1, 21, 28, 31, 32.
For other sumacs see page 61.

Rose-acacia

Robinia hispida (5-4B)

Loose shrub to 3 ft. or more, with attractive purplish-rose pea-like flowers in late May. Stems with red bristles. Useful for bank planting because of its suckering habit. BA, DU, GA, LT, 21, 28.

Rose

Rosa nitida (3)

Shrub to 2-3 ft. with single rosy-red flowers in late May or June. Small red fruit. Lustrous foliage. KN, SH, 28.

Rosa rugosa hybrid 'Max Graf' (3?)

Trailing rose with single pink flowers. Ground cover. FO, KN, SQ, WN, 28.

Rosa wichuraiana (5)

MEMORIAL ROSE

Trailing shrub suitable as a bank cover. 2-in.-wide white flowers in early summer. Shiny foliage retained late in autumn. Fruits red. ED, FO, KN, PW, SH, SQ, WN, 5, 20, 21, 28, 31, 36.

For other roses see page 50 and 61.

Willow

Salix purpurea 'Nana' (3)

DWARF ARCTIC WILLOW

Compact shrub to 4 ft. Grayish foliage. Useful for low hedges. BA, CO, EM, FA, FE, MB, ML, RK, RO, ST, 10, 21, 31, 32.

Salix repens (4)

CREeping WILLOW

Prostrate shrub to 3 ft. high. Ascending branches; small leaves. CB, LC, MB, SH.

Salix uva-ursi (2-1)

BEARBERRY WILLOW

Creeping, forming dense mats. To 2-3 in. high. Catkins in early spring. MF, WA.

Sarcococca

Sarcococca hookeriana humilis (6-5B)

Shrub to 6 in. Handsome evergreen leaves. Fragrant small white flowers. Ground cover. AL, CB, WA, 8, 22, 23, 38, 42, 44.

Sarcococca ruscifolia (7)

Evergreen shrub to 4-5 ft. Roundish deep green leaves. Inconspicuous but fragrant flowers in autumn or early winter. Dark scarlet berries. Shade. BH, ML, PT, 30, 42, 44.

Siphonosmanthus

Siphonosmanthus (Osmanthus) delavayi (7)

Evergreen shrub to 3-4 ft. with small glossy dark green leaves. Handsome. Blue-black berries. AL, 23, 33.

Skimmia

Skimmia japonica (6B)

JAPANESE SKIMMIA

Handsome compact evergreen shrub to 4 ft. Bright red berries retained over a long period in autumn. Dioecious. Modestly ornamental, fragrant yellowish-white flowers in late April or early May. This and the following species require winter shade. CB, ED, PF, RO, WA, 17, 21, 23, 41, 42.

Skimmia reevesiana (6B)

REEVES SKIMMIA

Evergreen shrub to 1½ ft. Small white flowers. Dull red berries, borne on each plant, retained late into winter. Ground cover. WA.

Spirea

Spiraea albiflora (callosa alba) (4)

JAPANESE WHITE SPIREA

Tight mound to 18 in. Flat clusters of white flowers in early summer. FO, RO.

Spiraea bullata (5)

Twiggy shrub to 15 in. Crinkly leaves. Bright pink flowers in early summer. AL, MF, VI.

Spiraea bumalda 'Anthony Waterer' (japonica × albiflora) (3)

Dense shrub to 3 ft. Flat clusters of crimson

flowers in early summer. Prune spent flower stalks to prolong bloom. BA, CO, DA, ED, FA, FE, GE, KR, LE, ML, RO, SH, WB, ZI, S, 11, 20, 21, 28, 31, 42, 44.*

Other Forms:

'Crispa.' To 18 in. Small twisted leaves, refined for a spirea. KR, SH, 1.

'Froebelii.' FROEBEL SPIREA. Similar to 'Anthony Waterer,' but slightly taller and with sufficient new growth in summer to hide the spent flowers. AE, BA, CO, FA, FE, KS, PV, RS, SH, SQ, ST, ZI, 16, 19, 31, 32.

Spiraea japonica alpina (5)

JAPANESE ALPINE SPIREA

Tight mound to 1 ft. Light pink flowers in mid-June. Refined. AL, CB, IN, LC, PR, 5, 20, 36.

Spiraea japonica 'Atrosanguinea' ('Coccinea') (5)

Shrub to 4 ft., new foliage reddish. Flat clusters of deep crimson flowers in summer. BA, CB, IN, KE, LI, MB, 3, 5, 6, 31.

Stephanandra

Stephanandra incisa (flexuosa) 'Crispa' (5)

DWARF STEPHANANDRA

Shrub to 2 ft. with refined, deeply cut leaves. Suitable as a ground or bank cover. Best trimmed in early spring to retain good form. Its suckering habit can make it a nuisance in small gardens where it is so often planted because of its neat foliage. ML, PF, SH, WA, WG, 5, 36.

Germander

Teucrium chamaedrys (6)

Dense semi-evergreen shrublet to 8-10 in. Attractive small leaves. Rose-purple flowers in summer. Edging or miniature hedge plant. DA, HY, KR, PY, WI, 1, 33, 36, 43, 44. *Selected Form:* 'Prostrata.' 3-in.-high mat. HY, PR, PY, WA, WI, 43, 47.

Blueberry, Cranberry

Vaccinium angustifolium (pennsylvanicum) (2)

LOWBUSH BLUEBERRY

Loose ground cover to about 8 in. Scarlet autumn color. Acid soil. Edible fruit. DU, SN.

Vaccinium vitis-idaea minus (3)

MOUNTAIN CRANBERRY

Mat-forming shrublet to 4 in. high. Very small leaves. Pinkish-white flowers in mid-May. Red berries. Full sun. Ground cover. AL, MF, OL, PK, SO, VI, WA, WN, S, 22, 35, 42.



Marjorie J. Dietz

The gold flowers of *Hypericum* 'Hidcote.'

Viburnum

Viburnum davidii (7)

DAVID VIBURNUM

Compact evergreen shrub, usually to only 3 ft. in the U. S. Grown mainly for its long, deeply creased leaves. Small white flower clusters in late May or June. Occasionally with light blue berries in autumn. Handsome ground cover in the Northwest. ED, ML, SI, WA, 17, 23, 42, 44.

Viburnum opulus 'Nanum' (4?)

Unusually dense, almost ball-shaped shrub to about 3 ft. Grown chiefly for its refined, closely set, small leaves. Non-flowering. Not to be confused with 'Compactum' (see page 63). LC, LT, MB, PF, PK, RO, RS, SH, SQ, WF, WG, 5, 10, 16, 28, 32, 35, 38. *For other viburnums see page 52 and 62.*

Yellow-root

Xanthorhiza simplicissima (apiifolia) (4)

Stoloniferous shrub to 2 ft. high. Finely cut leaves. Tiny but interesting brownish-purple flowers in late April. A vigorous spreader, useful as a ground cover. GA, LT, PF, SN, WN, 28.

Zenobia

Zenobia pulverulenta (5)

Low, more-or-less mounded shrub to about 4 ft. Grayish-green foliage. Dainty white bell-shaped flowers in late May or early June. Needs acid, peaty soil. Heath family. DA, WA.

DWARF CONIFERS

Those that are low-growing or slow-growing

Fir

Abies balsamea hudsonia (3)

Flat-topped deep green form to about 2½ ft. AL, OL, PK, RF, SP, WF.

Abies balsamea 'Nana' (3)

Unusually slow-growing, ball-shaped fir to 1½ or 2 ft. AL, MF, RA, RF, SI, SO, SP, WA, S, 23, 35, 38.

Abies concolor 'Compacta' (4)

Irregular, flat-topped; to about 2½ ft. Gray needles. RF, SP.

Abies koreana 'Prostrata' (5)

Low, compact, spreading shrub with horizontal or upturned branches. RF, SP, WA, WF, 15, 22.

Abies lasiocarpa 'Compacta' (6)

Broadly conical, densely branched; blue-gray foliage. Vigorous. KI, RF, SI, SP, WA, 15.

Abies procera (nobilis) 'Prostrata' (4)

Irregular, more-or-less flat-topped; to 3 ft. Glaucescous foliage. PK, RF, SP, WA, 38.

Cedar

Cedrus libani 'Comte de Dijon' (6)

Dense, broadly conical; to 4-5 ft. Short needles. AL, KI, RF, SP.

Cedrus libani 'Sargentii' (6)

Very dwarf and unusually slow-growing; pendulous branches. AL, KI, OL, PA, PK, RF, SP, 17, 33, 38.

False-cypress

Note: The name "Retinospora" (more correctly "Retinispora"), which was used in the 19th century for certain false-cypress forms with awl-shaped ("juvenile") leaves, is obsolete botanically, but is still sometimes used. Some nurseries still list *Chamaecyparis* under "Retinospora."

Chamaecyparis lawsoniana 'Ellwoodii' (6-5B)

Slow-growing shrub to about 8 ft. Spire-like. KI, MD, ML, PT, RF, SI, SP, WA, 4, 23, 36, 42, 44, 46.

Chamaecyparis lawsoniana 'Forsteckensis' (6)

Dense globe with congested growths. A slow-growing form with gray foliage. Eventually to about 1½ ft. AL, KI, MF, RF, SP, WA.

Chamaecyparis lawsoniana 'Gimbornii' (6)
Oval form to about 2 ft. Rigid, slow-growing. AL, RF, SP, WA.

Chamaecyparis lawsoniana 'Minima' (6)

Broad-based conical shape. Slow-growing to 2-2½ ft. Light green. MF, RA, RF, SP, WA.

Chamaecyparis lawsoniana 'Minima Glauca' (6)

Distinctive for its metallic blue-gray foliage. To about 3 ft. AL, KI, RA, RF, SP, 4, 8, 23, 33, 36, 46.

Chamaecyparis lawsoniana 'Pygmaea Argentea' (6)

Slow-growing to about 2 ft. Variegated. AL, RF, SP.

Chamaecyparis obtusa 'Caespitosa' (5)

One of the smallest conifers, seldom more than 8-10 in. high. Ball-shaped. AL, KI, PA, RA, RF, SP.

Chamaecyparis obtusa 'Coralliformis' (5)

Twisted cord-like branches with adpressed leaves. To 3 ft. or more. AL, KI, ML, PK, RF, SP, VI, WF, 35.

Chamaecyparis obtusa 'Juniperoides' (5)

Very slow-growing, forming a tight green ball seldom more than 1 ft. AL, RA, RF, SP, 36, 38.

Chamaecyparis obtusa 'Lycopodioides' (5)

Shrub to 4½ ft. or more. Branches irregularly crowded. Loose growth habit. KI, PK, RA, RF, SP, WF, 33, 35.

Chamaecyparis obtusa 'Lycopodioides Aurea' (5)

Similar to the preceding, but with yellow foliage. Slower-growing. AL, KI, RF, SP.

Chamaecyparis obtusa 'Mariesii' ('Nana Albovariegata') (5)

Unusually slow-growing conical shape to about 2 ft. Variegated. AL, KI, RF, SP, VA.

Chamaecyparis obtusa 'Nana' (5)

Exceptionally slow-growing. Squat habit. To 2 ft. Dark green. Choice. AL, CB, GI, KI, ML, OL, PA, PK, RA, RF, SI, SP, VI, 1, 8, 17, 23, 33, 36, 38, 40.

Chamaecyparis obtusa 'Nana Gracilis' (5)

Slow-growing; broad conical shape and deep green foliage. Takes many years to attain 7 ft. AL, ED, GI, IY, MD, ML, PA, RA, RF, RI, SP, WA, WF, 4, 10, 35, 38, 41.

- Chamaecyparis obtusa 'Spiralis' (5)**
Small, stiffly upright form with curiously twisted branchlets. Distinct. RF, SP, WA.
- Chamaecyparis obtusa 'Tetragona Aurea' (5)**
Slow-growing to 6 ft. or more. Compact, conical. Short crowded branches. Yellow foliage. AL, KI, OL, PA, PK, RA, RF, SP, WF, S, 23, 35.
- Chamaecyparis pisifera 'Filifera Nana' (4)**
Dense, flat-topped; to about 3 ft. Branchlets fan-shaped. Dark bluish-green foliage. AL, SP, WA.
- Chamaecyparis pisifera 'Nana' (4)**
Squat, more-or-less globose. Glaucous foliage. To about 2 ft. in old age. ML, PK, RF, RO, SP, WA, 35.
- Chamaecyparis pisifera 'Plumosa Nana Aurea' (4)**
Slow-growing rounded form. To 2½ ft. Lacy branchlets. Young foliage golden yellow. AL, CB, PA, RA, RF, WF, 10.
- Chamaecyparis pisifera 'Squarrosa Minima' ('Squarrosa Pygmaea') (4)**
Dense bun to 1 ft. or more. Silvery gray. If vigorous whip-like shoots appear they should be pruned out to maintain compact, even form. Perhaps synonymous with 'Intermedia,' which left to its own devices may become a pyramidal tree growing to 10-12 ft. AL, CB, DA, PA, RF, RI, SO, SP, WA, WF.

Cryptomeria

- Cryptomeria japonica 'Elegans Nana' (6)**
Vigorous shrub to about 3 ft. Feathery foliage, purplish in winter. Distinct, but ages poorly. AL, RF, SP, WA.
- Cryptomeria japonica 'Globosa Nana' (5)**
Tight globe growing to perhaps 3 ft. Yellowish-green foliage in summer, slightly blue in winter. AL, KI, PA, RF, SP, WA.
- Cryptomeria japonica 'Jindai-Sugi' (6)**
Compact, upright habit, to 5 ft. or more. Slightly flattened top. AL, RF, SP, WA.
- Cryptomeria japonica 'Knaptonensis' (6)**
Tight cushion, growing slowly to about 2 ft. AL, RF, SP, WA.
- Cryptomeria japonica 'Monstrosa Nana' (6)**
Irregular, broadly pyramidal, to about 3 ft. Growth more-or-less congested. Best seen before giving it a trial. AL, KI, PA, RF, SP, WA.
- Cryptomeria japonica 'Pygmaea' (6)**
Slow-growing, irregularly flat-topped; to about 3 ft. Reddish-bronze in winter. AL, RF, SP, WA.

- Cryptomeria japonica 'Spiralis' (6)**
Slow-growing, rather open habit to about 3 ft. Needles twisted spirally along the stem. AL, RF, SP, WA.
- Cryptomeria japonica 'Vilmoriniana' (6)**
Dense rigid globe attaining 2-2½ ft. after many years. Foliage turns brown in winter, but not objectionably so. Handsome. AL, CB, MF, RF, SP, WA, 36, 38, 41.

Juniper

- Juniperus chinensis 'Armstrongii' (4)**
Dense shrub to 3 ft. high and as much across. Branches wide-spreading. Soft gray-green foliage. HE, LI, ML, PF, PV, RF, RI, SI, 11, 23, 25, 40, 42, 43, 44.
- Juniperus chinensis 'Blaauw' (4)**
Dense shrub to about 4 ft. with spreading branches. Somewhat vase-shaped. Leaves, mostly scale-like, blue-green. DA, GI, KS, LA, MF, RF, RK, SH, SI, WA, WE, 15, 16, 19, 23, 33, 36, 38, 42, 44.
- Juniperus chinensis 'Hetzii' (5-4B)**
HETZ JUNIPER
Broad upright shrub to 10 ft. or more. Vigorous. Fountain-like effect with age. Gray-green foliage. Hardly a dwarf, but included here for convenience. DA, FE, HE, LN, LT, PV, RI, RO, SH, 7, 9, 11, 12, 19, 31, 32, 33, 36, 41, 42.
- Juniperus chinensis 'Old Gold' (4)**
Wide-spreading compact shrub to 3-4 ft. Golden foliage. CO, KI, RF, SH, SI, SP, WA, WE, 23, 25, 33, 38, 42.
- Juniperus chinensis 'Pfitzeriana' (4)**
PFTZER JUNIPER
Vigorous broad shrub to 5 ft. or more. Gracefully irregular, arching branches. Foliage bright green to blue-green. Popular with reason. Most nurseries.
- Juniperus chinensis 'San Jose' (4)**
Spreading, loosely prostrate shrub to about 2 ft. high at maturity, but much broader. Gray-green. BA, HE, KS, LI, LN, MD, PV, RF, RO, 3, 4, 16, 19, 23, 25, 42, 43, 44, 46.
- Juniperus chinensis sargentii (4-3B)**
SARGENT JUNIPER, SHIMPAKU
Prostrate shrub to about 2 ft. high, spreading to as much as 10 ft. wide. Light green or bluish-green. Bonsai candidate, as are many other shrubby kinds of Chinese juniper. DA, FE, GI, LC, LI, LT, PF, PK, RK, RO, SI, 3, 15, 16, 19, 28, 33, 35, 38, 42*.
- Juniperus chinensis 'Sargentii Glauca' (4)**
Similar to the preceding, but with glaucous foliage. BA, CO, HE, HY, LI, MD, PV, RF, SH, WA, WN, 3, 6, 14, 15, 16, 25, 42, 44.

Juniperus communis 'Compressa' (5)

Very slow-growing sharply columnar form. Rarely attains 3 ft. Resembles a miniature Italian cypress. AL, MF, ML, OL, RF, SO, SP, WA, WF, 8, 23.

Juniperus communis 'Depressa Aurea' (4)

Prostrate shrub to 2-2½ ft. high, broadly spreading. Leaves shaded golden yellow to bronze. LC, OL, SH.

Juniperus communis 'Echiniformis' (4?)

A tiny prickly hummock. Slow-growing to about 1 ft. Distinctive. AL, KI, PA, RF, SP, WA.

Juniperus communis 'Hornibrookii' (4)

Ground-hugging mat to 2 ft. high. Small leaves densely crowded on the branches. KI, OL, RF, SP, S.

Juniperus communis 'Repanda' (4)

Dense prostrate shrub to about 1 ft. ED, KI, RF, SH, SP, 16, 35.

Juniperus conferta (5)

SHORE JUNIPER

Creeping prostrate shrub, ultimately to 1½ ft. high. Young growth light green, later grayish. GE, GI, HA, MF, ML, OL, PF, PK, PR, RF, SI, WF, 1, 3, 8, 13, 14, 28, 33, 42, 43.

Juniperus davurica 'Expansa' (squamata 'Parsonsii') (4)

PARSONS JUNIPER

Spreading flat-topped shrub. Gray-green. Ultimately a broad dome to 3 ft. tall. Branches horizontal, held above ground. BA, PK, RO, 6, 12, 15, 25, 36, 38, 40, 44.

Juniperus horizontalis (3)

CREeping JUNIPER

Prostrate mat with long creeping branches. To 1 ft. high. Gray or bluish-green foliage. This and its forms are handsome ground or bank covers on sunny sites. GI, KR, PF, WN, 9, 23, 33, 36.

Juniperus horizontalis 'Bar Harbor' (3)

Dense mat. Steel blue foliage. BA, HE, IY, MD, MF, ML, PF, PR, PT, PV, RO, WN, 1, 3, 12, 15, 16, 28, 38, 40, 42, 44.*

Juniperus horizontalis 'Douglasii' (3)

WAUKEGAN JUNIPER

Prostrate branches and ascending branchlets. Blue-green in summer, purple in winter. BA, ED, GD, GI, KI, PK, RF, SI, WF, WN, 1, 3, 16, 19, 21, 23, 25, 28, 32, 42.*

Juniperus horizontalis 'Glomerata' (4)

Prostrate. Branches end in tight clusters. OL, RF, WA.

Juniperus horizontalis 'Plumosa' (4)

ANDORRA JUNIPER

Spreading, prostrate. To 2 ft. Light green.

It is available from most nurseries.

Juniperus horizontalis 'Plumosa Compacta' (4)

Prostrate compact form of Andorra juniper. CB, FE, GE, LI, MD, MK, ML, PV, SA, SH, 1, 5, 6, 12, 15, 23, 35, 38, 41, 44, 45.

Juniperus horizontalis 'Wiltonii' (3)

Silvery blue carpet. One of the best. BA, DA, GD, LI, ML, MU, OL, PF, RO, SH, SI, WN, 1, 3, 6, 28, 35, 38, 42, 44, 45.*

Juniperus procumbens (5-4B)

JAPANESE JUNIPER

Rigid, spreading, thick mat with ascending branchlets. 1-2 ft. Bluish-green. Bonsai candidate. BA, FE, KI, LI, LN, MD, MK, NE, PT, PV, SI, VI, 13, 14, 16, 19, 25, 31, 35, 42.

Juniperus procumbens 'Nana' (4)

Dwarf form of the preceding. Choice. Bonsai candidate. Plants vary, some being more tightly knit than others. Material sold in the trade as *J. squamata* 'Prostrata' is usually *J. procumbens* 'Nana.' The true *squamata* 'Prostrata,' a different plant with branchlets nodding at the tips, is seldom encountered in American gardens. AL, BA, HE, MF, ML, OL, PA, RF, RO, SH, SI, SO, SP, VI, WF, 15, 16, 23, 31, 35, 38, 40, 42, 44.*

Juniperus sabina 'Arcadia' (4)

Dense spreading form to about 1½ ft. high. Light green. BA, CO, ED, KI, KS, LI, PT, RF, SH, 16, 23, 38, 43, 44, 46.

Juniperus sabina tamariscifolia (4)

Bright green prostrate shrub to about 2 ft. high. Branchlets partly upright. ED, GI, KS, LI, MA, PF, RI, RO, SH, SI, WF, 16, 23, 31, 33, 42, 43, 44, 46.

Juniperus squamata 'Meyeri' (4)

Loose shrub to 4 ft. or more. Irregularly upright. Beautiful steel blue foliage. Best while young. AL, BH, KS, LI, MF, MK, ML, NE, RK, SH, SI, 1, 6, 16, 21, 23, 38, 42, 44.

Juniperus virginiana 'Gray Owl' (4)

Wide-spreading shrub to 4 ft. tall. Habit similar to Pfitzer juniper. Silvery gray. AL, BA, CB, CO, HY, KI, SH, 16, 25.

Spruce

Picea abies (excelsa) 'Clanbrassiliana' (3)

Dense flat-topped bush with crowded branches. To about 6 ft. in old age. Bright green. Prominent reddish-brown buds. KI, MF, PK, RA, RF, SP, WN, 21, 33, 38.

Picea abies 'Echiniformis' (3)

Dense cushion to 2-3 ft. Crowded branch-

lets and small sharp needles. Light green. AL, KI, PA, RF, SP, WA, 38.

***Picea abies* 'Gregoryana' (3)**

Dense globe or cushion to about 2 ft. Irregular with age. Grayish-green. AL, KI, LT, PA, PK, RF, RO, SP, VI, 8, 38.

***Picea abies* 'Maxwellii' (3)**

Dense, more-or-less flat cushion to 3-4 ft. Bright green. If strong shoots with large needles appear, they should be cut out. CB, KI, ML, OL, PA, PF, PK, RF, RO, SP, WA, WF, 8, 33, 35, 38, 42.

***Picea abies* 'Nidiformis' (3)**

To about 3½ ft. While young, the branches are arranged to form a flattened depression, somewhat resembling a bird's nest. BA, CB, MF, ML, OL, PA, PK, RI, RO, SH, SI, VI, WF, 6, 28, 33, 35, 36, 38, 41, 42.*

***Picea abies* 'Procumbens' (3)**

Dense bush to 3-4 ft. and two-to-three times as broad as tall. Horizontal branching with exceptionally long needles for a dwarf form. Light green. MF, RF, SP, 38.

***Picea abies* 'Pumila' (3)**

Low, spreading; to 3 ft., and broader than tall. Soft needles. MF, PA, RF, SP, WA, 8, 23, 38.

***Picea abies* 'Remontii' (3)**

Dense conical shape; to about 6 ft. Bright green. Brown buds conspicuous in winter. KI, LT, ML, RF, SP, VI, WA, WN, 23, 33, 35, 38.

***Picea abies* 'Repens' (3)**

Prostrate or spreading form to about 1½ ft. tall. Dense branches rest flat on each other. Light green. AL, KI, PK, RA, RF, SP, VI, WF, 8, 23, 33, 38.

***Picea abies* 'Tabuliformis' (3)**

Low mat with horizontal branching. Flat-topped. To 2½-3 ft. tall. Light green. KI, LT, PA, SP, 38.

***Picea glauca* 'Conica' (3)**

DWARF ALBERTA SPRUCE

Dense symmetrical cone; after many years to about 10 ft., with a spread of 4-5 ft. Very formal. AL, CB, ED, HE, LT, OL, RA, RI, RO, SH, VI, WF, 1, 3, 6, 15, 28, 35, 38, 40, 42.*

***Picea pungens* 'Glauca Prostrata' (3)**

Handsome wide-spreading, prostrate form of Colorado blue spruce. Should a leader form, it may be cut out to preserve the prostrate habit. PA, PK, RF, SP, WA.

***Picea pungens* 'Globosa' ('Glauca Globosa') (3)**

Somewhat flat-topped globe form of Colorado blue spruce. To about 4 ft. KI,

MD, OL, PA, RF, SP, WA, WF, 15, 38.

***Picea pungens* 'Montgomery' (3)**

Dense spruce to 5-6 ft. high. Broad. Blue. KI, MF, PA, PK, RF, SP, WA, 8, 33, 38.

Pine

***Pinus aristata* (5)**

BRISTLECONE PINE

A dense, very slow-growing low shrub when grown in the East. Sometimes a small tree in western gardens. CB, DA, KI, LI, ML, MU, OL, PA, PK, RA, RO, SI, SP, 1, 8, 10, 23, 33, 35, 38, 42.

***Pinus densiflora* 'Pendula' (4-3B)**

Pendulous, more-or-less prostrate form. Stake while young for best effect. AL, MD, PK, RF, SP, 15, 38.

***Pinus densiflora* 'Umbraculifera' (4-3B)**

TANYOSHIO PINE

Densely shrubby while young, ultimately an umbrella-shaped tree to 10 ft. or more. Attractive orange-brown bark on older specimens. AL, LI, OL, PA, PT, RF, RO, SP, VI, WN, 8, 21, 22, 38, 42.

***Pinus mugo* var. *mugo* (mughus) (3)**

MUGHO PINE

Slow-growing shrub to 8 ft. or more, as broad as tall. Pinch new shoots or "candles" while young to make a dense compact plant. Variable. AE, BU, CB, ED, FA, FE, LT, MU, NE, PW, RI, SI, 9, 10, 11, 23, 35, 40, 41, 42.*

***Pinus mugo* *pumilio* (3)**

A more-or-less prostrate variety of mugho pine. Lower growing and more dense than the preceding. Deep green. CO, KI, LI, ML, OL, PK, RA, RF, RI, SI, SP, 15, 33, 38, 39, 42.

***Pinus strobus* 'Nana' (3)**

DWARF WHITE PINE

Broad dense bush to 4-6 ft. Bluish-green. AL, CB, DA, KI, OL, PA, PF, RF, SP, VI, WA, WN, 8, 15, 17, 21, 35, 38, 40, 42.

***Pinus strobus* 'Umbraculifera' (3)**

Broad dome-shaped shrub with short trunk. Leaf clusters drooping. Ultimately to 10-12 ft. KI, PA, PK, RF, SP, WA, 38.

***Pinus sylvestris* 'Beuvronensis' (3)**

A Scots pine form that is a densely branched little mound. Perhaps to 2 ft. and a little broader. Leaves slightly twisted. AL, KI, PA, PK, RF, SP, WA.

Yew

***Taxus baccata* 'Adpressa Fowle' (5)**

Dense shrub, very slow-growing to about 5 ft. and broader than tall. Very short

needles. Distinctive. RF, WA, WN.

Taxus baccata 'Adpressa Stricta' (6)

Columnar form to 10-12 ft. Short horizontal branches. SP, WA.

Taxus baccata 'Repandens' (5)

WEeping ENGLISH YEW

Shrub to about 3 ft. high and 6 ft. wide. Branches sweep the ground. Relatively long needles. Deep green. Attractive loose ground cover on a shady bank. DA, EA, ED, FO, HY, LA, LI, LT, MD, RF, WA, WB, 23, 28, 33, 36, 38, 40, 41, 42.

Taxus cuspidata 'Densa' (4)

Dense cushion, growing slowly to 4 ft. high and twice as broad. One of the best forms of Japanese yew. BT, LC, LI, RF, RO, WF, 2, 3, 6, 19, 21, 23, 28, 32, 38, 41.

Taxus cuspidata nana (4)

DWARF JAPANESE YEW

A low, dense, wide-spreading shrub for many years, but ultimately reaching 8 ft. or more, and twice as broad. Short bright green needles. AL, BA, CB, CO, DA, HY, LC, LT, PF, RO, SH, SI, WB, 9, 10, 16, 22, 23, 28, 41, 42.*

Note: Many other forms of Japanese yew and hybrid yew (*T. media*) exist in the trade. Virtually every general nursery in colder parts of the country stocks at least several

forms. Should it not be possible to obtain these plants locally, most of the firms cited in this Handbook will be able to supply them.

Arbor-vitae

Thuja occidentalis 'Ellwangeriana Aurea' (3)

A tight pyramid to about 6 ft. Golden foliage. AL, MF, SH, SP, WA, 8, 23, 33, 35.

Thuja occidentalis 'Ericoides' (4)

Rather open broad pyramid to 4-5 ft. Dull green. Foliage brown in winter. RF.

Thuja occidentalis 'Globosa' (3)

Compact globe form to 5-6 ft., somewhat broader. Bright green. PA, 42, 47.

Thuja occidentalis 'Hetz Midget' (3)

Very slow-growing, globe-shaped shrub; 2-2½ ft. after many years. ED, GI, ML, OL, PA, PK, RA, RF, RK, SP, WA, 1, 23, 35.

Thuja occidentalis 'Woodwardii' (3)

Dense globe form, spreading with age. Old shrubs may attain 6 ft. or more. Green winter and summer. CO, GI, LI, LT, ML, PV, PW, RO, SA, SH, SI, WE, WN, 10, 11, 16, 19, 23, 25, 42.

Thuja orientalis 'Aurea Nana' (6)

Oval shape; height about 5 ft. Golden



The dwarf hemlock (*Tsuga canadensis* 'Minuta') remains astonishingly compact—rarely exceeding 1 foot in height as well as width. It is excellent in rock gardens.



Dwarf evergreens—spruce and mugho pine—flank a trifoliolate-orange, chosen for the site because of the delicate tracery of its reflection against the wall.

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yellow in spring. Often called "Berekmans arbor-vitae" in the trade. AL, DA, GE, LA, PT, RF, SH, TE, WA, WB, 11, 20, 23, 33, 36, 42, 44, 46.

Thuja orientalis 'Filiformis Erecta' (6)

Oval form to about 4 ft. Shoots erect, whip-like. Yellow-green in summer, brownish-green in winter. PA, SP.

Thuja plicata 'Cuprea' (5)

Low, conical shrub, perhaps to 3 ft. after many years. Young foliage is bright gold. RF, SP, WA.

Thuja plicata 'Rogersii' (5)

Densely compact pyramid to about 4 ft. More-or-less oval or globe-shaped while young. Golden yellow. AL, RF, SP, WA.

Hiba Arbor-vitae

Thujaopsis dolabrata 'Nana' (6)

Densely bushy, somewhat spreading to 3-4 ft. Foliage resembles *Thuja*, but is more flattened. Shiny bright green. AL, MF, RF, SP, WA.

Hemlock

Tsuga canadensis 'Bennett' (4)

Spreading form with weeping branch tips. To about 2 ft., and broader than tall. Like a Sargent weeping hemlock in miniature. KI, ML, PK, RF, SP, WA, 15, 38.

Tsuga canadensis 'Cole' (4)

COLE'S PROSTRATE HEMLOCK

The most prostrate form, just a few inches high, although with age it becomes somewhat mounded. Sometimes staked and allowed to droop, resembling a diminutive Sargent weeping hemlock. Usually performs best in part shade. KI, OL, PK, RF, SP, WA, 15.

Tsuga canadensis 'Horsford's Dwarf' (4)

Symmetrical globe to 1 ft. or slightly more. Short, closely set needles. PA, RF, SP.

Tsuga canadensis 'Hussii' (4)

Upright shrub to about 3½ ft. Short, interestingly asymmetrical branches. KI, PA, RF, SP, WA, WN, 38.

Tsuga canadensis 'Jervis' (4)

Compact, somewhat irregular pyramid with ascending branches. To about 2½ ft. PA, RF, SP, 15, 38.

Tsuga canadensis 'Minima' (4)

Dense globe with short needles. 2-3 ft. KI, PA, RF, SP.

Tsuga canadensis 'Minuta' (4)

An irregular globe, as wide as it is high. Very slow-growing to about 1 ft. KI, PA, RF, SP.

Tsuga canadensis 'Pendula'

SARGENT WEEPING HEMLOCK (See p. 39)

RETAIL NURSERY SOURCES

Retail nurseries, including those with mixed retail-wholesale operations, are given **letter codes**. Exclusively wholesale nurseries, designated by **number codes**, are listed separately.

If you are not a nurseryman, please do not

order directly from wholesale firms. In the few instances where only wholesale sources have been given for plants, ask your local nurseryman or garden center to order them for you from the particular wholesale firm.

- Ackerman Nurseries, Lake St., Bridgman, Michigan 49106. (616) 465-3422. Retail and wholesale. Fruit and nut trees, berry plants, ornamental trees and shrubs. Mail-order catalog.
- Adams Nursery, Box 525, Rte. 20, Westfield, Massachusetts 01085. (413) 562-3644, 736-0443. Retail and wholesale. General nursery stock. Catalog.
- AE Alberta Nurseries & Seeds, Ltd., Bowden, Manitoba, Canada. (403) 224-3362. Mostly retail. Ornamental and fruit trees. Vegetable and flower seed. Mail-order catalog.
- AH J. Herbert Alexander, 1224 Wareham St., Middleboro, Massachusetts 02346. (617) 947-3397. Lilacs, flowering quince, blueberries, phlox. Descriptive mail-order list.
- Alley Pond Nurseries, 323-10 Horace Harding Blvd., Bayside, New York 11364. (212) 225-8700. Local retail. General nursery stock.
- AL Alpenglow Gardens (Michaud & Company), 13328 King George Highway, North Surrey, British Columbia, Canada. (604) 581-8733. Rock garden plants, dwarf conifers. Mail-order catalog and periodic supplements.
- Armstrong Nurseries, 830 W. Phillips, Ontario, California 91764. (714) 984-1211. Retail and wholesale. Hybrid tea and other roses. Mail-order catalog.
- Arnold's Clematis Nursery, 2005 S. E. Park Ave., Milwaukie, Oregon 97222. (503) 654-1347. Retail. Extensive clematis listing. Mail-order catalog 25¢.
- Arrowhead Gardens, 115 Boston Post Rd., Wayland, Massachusetts 01778. (617) 358-7333. Retail and wholesale. General nursery stock.
- Avalon Mountain Gardens, Dana, North Carolina 28724. (704) 692-9898. Retail. Azaleas, heathers and perennials. List. Ships.
- BA Bachman's, Inc., 6010 Lyndale Ave. South, Minneapolis, Minnesota 55423. (612) 827-3561. Retail and wholesale. Garden centers. General nursery stock. Retail catalog. Ships.
- BH Boething Treeland Farms, 23475 Ventura Blvd., Woodland Hills, California 91364. (213) 347-8822. Eight nurseries and garden centers in Los Angeles, Riverside and Ventura counties. Container-grown plants. Service charge on truck deliveries more than 100 miles from Woodland Hills. Retail catalog.
- BL Warren Baldsiefen, Box 88, Bellvale, New York 10912. Retail. Rhododendrons. Mail-order catalog \$1.50, refundable on first purchase. Nursery not open to visitors.
- Patsy Bello Nurseries, 5600 Flatlands Ave., Brooklyn, New York 11234. (212) 743-0815, 444-3800. Retail and wholesale. General nursery stock. Does not ship.
- BO Bountiful Ridge Nurseries, Princess Anne, Maryland 21853. (301) 651-0400. Fruit and nut trees, berry plants and ornamentals. Retail and wholesale. Garden center. Mail-order catalog.
- The Bovees, 1735 S. W. Coronado, Portland, Oregon 97219. (503) 244-9341. Retail only. Uncommon rhododendron species and hybrids, Exbury azaleas. Visitors by appointment. Mail-order catalog 25¢.
- BR Brimfield Gardens Nursery, 245 Brimfield Rd., Wethersfield, Connecticut 06109. (203) 529-0795. Retail. Rare trees and shrubs, dwarf conifers. Visitors by appointment. Catalog 25¢. Ships.
- BT Bunting's Nurseries, Selbyville, Delaware 19975. (302) 436-8231. Separate retail and wholesale catalogs. Strawberries, fruit and nut trees, ornamentals. Mail-order catalog.

- Burgess Seed and Plant Co., Box 218, Galesburg, Michigan 49053. (616) 665-7079. Retail. Fruit and nut trees, berry plants, ornamentals. Vegetable and flower seed. House plants, garden supplies. Mail-order catalog.
- BU W. Atlee Burpee Co., Hunting Park Ave. at 18th St., Philadelphia, Pennsylvania 19132. (215) 228-8800. Branches in Clinton, Iowa and Riverside, California. Vegetable and flower seeds, general nursery stock. Trees and shrubs sold retail. Mail-order catalog.
- CA California Nursery Co., 36501 Niles Blvd., Fremont (Niles District), California 94536. (415) 797-3311. Roses, fruit and ornamental trees. Berry plants, nut trees. General catalog. Ships retail.
- CB Carroll Gardens, E. Main St. Ext., Westminster, Maryland 21157. (301) 848-5422. Retail and wholesale. Dwarf evergreens, trees and shrubs, roses, perennials, herbs and ground covers. Mail-order catalog.
- City of Glass, Melville Rd., Farmingdale, New York 11735. (516) 249-1700. Garden center. Local retail. General nursery stock.
- CM Comerford's, Box 100, Marion, Oregon 97359. (503) 769-5278. Retail and wholesale. Rhododendrons, Exbury and other azaleas. Hard-to-find cultivars. Mail-order catalog.
- CO John Connon Nurseries, Waterdown, Ontario, Canada. (416) 689-4631. Retail and wholesale. General nursery stock. Mail-order catalog.
- Corliss Bros. Garden Center, Ipswich, Massachusetts. See #6 in wholesale list.
- DA Dauber's Nurseries, 1705 N. George St., Box 1746, York, Pennsylvania 17405. (717) 764-4553. Retail and wholesale. Uncommon trees and shrubs, often of landscape size. Hollies. Retail catalog.
- DE Devon Nurseries, 1408 Royal Bank Building, Edmonton, Alberta, Canada. (403) 424-9696. Retail (catalog) and wholesale (list). General nursery stock and perennials. Ships.
- Sam Dible Nursery, R.F.D. 3, Shelocta, Pennsylvania 15774. (412) 726-5377. Retail and wholesale. Evergreens for Christmas tree plantings, reforestation. Ships.
- DO Bill Dodd Nurseries, Box 235, Semmes, Alabama 36575. (205) 649-2398. Retail. Price list of uncommon magnolias. Ships. Outlet for hard-to-find native rhododendrons and azaleas.
- DU Dutch Mountain Nursery, Augusta, Michigan 49012. (616) 731-4550. Retail. Trees and shrubs for wildlife plantings. Price list. Ships.
- EA Eastern Shore Nurseries, Box 743, Rte. 331, Easton, Maryland 21601. (301) 822-1320. Retail and wholesale. General nursery stock, often of landscape size. Catalog. Ships.
- ED H. M. Eddie & Sons, 4100 S. W. Marine Dr., Vancouver, British Columbia, Canada. (604) 261-3188. Retail and wholesale. General nursery stock, roses. Mail-order catalog.
- Eisler Nurseries, Box 70, 219 E. Pearl St., Butler, Pennsylvania 16001. (412) 287-3703. General nursery stock with emphasis on landscape sizes. Retail catalog, with price adjustment for trade customers.
- EM Emlong Nurseries, Stevensville, Michigan 49127. (616) 429-3431. Retail and wholesale. Garden centers in Stevensville and Niles, Mich. General nursery stock. Fruit trees. Mail-order catalog.
- FA Farmer Seed and Nursery Co., Rte. 60, Faribault, Minnesota 55021. (507) 334-6421. Seven Minn. stores. General nursery stock, vegetable and flower seeds, garden supplies. Mail-order catalog.
- FE Earl Ferris Nursery, 811 Fourth St. N. E., Hampton, Iowa 50441. (515) 456-2563. Retail. Wholesale mainly for evergreens and shrubs. Garden center. General nursery stock. Mail-order catalog.
- Henry Field Seed and Nursery Co., 407 Sycamore St., Shenandoah, Iowa 51601. (712) 246-2110. Retail and wholesale. General nursery stock. Mail-order catalog.
- FO Fiore Enterprises, Rte. 22, Prairie View, Illinois 60069. (312) 634-3400. Retail; also wholesale (as Charles Fiore Nurseries). Trees and shrubs, mainly of landscape size. Separate retail and wholesale catalogs. Ships.
- Flickingers' Nursery, Sagamore, Pennsylvania 16250. (412) 783-6528. Retail and wholesale. Evergreen seedlings for Christmas trees and reforestation. Mail-order price list.

- Mabel Franklin, 9225 S. Penn Ave., Minneapolis, Minnesota 55431. (612) 881-7870. Lilacs. Mail-order price list.
- French's Garden Center, 1215 W. Baltimore Pike (Rte. 1), Lima (Delaware County), Pennsylvania 19060. (215) 566-4270. Local retail. General nursery stock.
- Game Food Nurseries, Box 371, Oshkosh, Wisconsin 54901. (414) 235-8160. Wild rice; other marsh and upland plants for gamebirds. Seeds. Catalog 25¢. Ships.
- The Garden Spot, 4032 Rosewood Dr., Columbia, South Carolina 29205. Cuttings of 100 kinds of English ivy (*Hedera helix*). Euonymus, liriope and vinca forms. Cross vine (*Bignonia caprolata*). List. Ships.
- GA Gardens of the Blue Ridge, Ashford (McDowell County), North Carolina 28603. (704) 756-4339. Nursery on Rte. 221 in Pineola. Retail, limited wholesale. Native trees and shrubs, wide selection of wildflowers. Mail-order catalog.
- GD Gardenside Nurseries, Shelburne, Vermont 05482. (802) 985-2735. Retail. General nursery stock, landscape size. Price list. Does not ship.
- D. S. George Nurseries, 2491 Penfield Rd., Fairport, New York 14450. (716) 377-0731. Retail and wholesale. Clematis. List 10¢. Ships.
- GE Gilmore Plant & Bulb Co., Box 8, Rte. 421, Julian, North Carolina 27283. (919) 685-4451. Retail and wholesale. General nursery stock, evergreens, fruit trees. Catalog.
- GI Girard Nurseries, R. D. #4, North Ridge East, Geneva, Ohio 44041. (216) 466-2881. Retail and wholesale. Dwarf and unusual evergreens, azaleas, uncommon trees. Pre-bonsai conifers. Conifer seeds. Mail-order catalog.
- GO Gossler Farms Nursery, 1200 Weaver Rd., Springfield, Oregon 97477. (503) 746-3922. Retail. Rare magnolias. Flowering cherries. Trees chosen for bark character. *Eucryphia*. Unusually refined selection. Price list. Ships.
- GU Gurney Seed & Nursery Co., Yankton, South Dakota 57078. (605) 665-7481. Retail. Vegetable and flower seeds. Trees and shrubs for the Plains. Garden supplies. Mail-order catalog.
- Handleman's Garden Center, 16 Reservoir Rd., White Plains, New York 10603. (914) 949-3613. Local retail. General nursery stock.
- HA H. G. Hastings Co., Box 4088, Atlanta, Georgia 30302. (404) 522-9464. Three garden centers in Atlanta, one each in Birmingham and Charlotte. Retail and wholesale. Camellias, azaleas and other broad-leaf evergreens for the South. Roses, vegetable and flower seed. Fruit trees. Ornamental trees and shrubs. Mail-order catalog.
- HE Heard Gardens, 5355 Merle Hay Rd. (Rte. No. 1, Box 134), Des Moines, Iowa 50323. (515) 276-4533. Retail and wholesale. Trees and shrubs of landscape size. Large selection of lilacs and crab apples. No catalog, but willing to ship particular items retail.
- Alexander I. Heimlich Nursery & Garden Center, 71 Burlington St., Woburn, Massachusetts 01801. (617) 933-7053. Local retail. Dwarf evergreens.
- Heronwood Nursery, Rear Admiral Neill Phillips, Rte. 50, Upperville, Virginia 22176. (703) 592-3788. Topiary.
- Hillier & Sons, Winchester, England. Probably the largest selection of trees and shrubs grown anywhere by a commercial firm. Import permits needed (see page 89).
- C. M. Hobbs & Sons, 9300 W. Washington St., Bridgeport, Indiana 46231. (317) 241-9253. Retail and wholesale. Trees and shrubs, often of landscape size. Limited retail shipment.
- Holly Heath Nursery, Rte. 25A, Wading River, New York (mailing address: Box 55A, Calverton, New York 11933). (516) 727-0859. Retail. Holly, heather, Glenn Dale and other azaleas, dwarf plants. Does not ship.
- HY Stephen Hoyt's Sons Co., 529 Carter St., New Canaan, Connecticut 06840. (203) 966-1633. Retail and wholesale. As the Handbook goes to press, word has been received that this nursery is going out of business.
- Huttar's Garden Center, 3662 Richmond Rd., Staten Island, New York 10306. (212) 351-5100. Retail. General nursery stock. Does not ship.
- ID Indian Run Nursery, Allentown Rd., Robbinsville, New Jersey 08691. (609) 259-2600. Retail. Rhododendrons. Catalog. Does not ship. Closed Mondays.

- IN** Inter-State Nurseries, Hamburg, Iowa 51640. (712) 382-2411. Retail and wholesale. General nursery stock, fruit trees, perennials. Mail-order catalog.
- IS** Island Gardens, 701 Goodpasture Rd., Eugene, Oregon 97401. (503) 343-4711. Retail and wholesale. Exbury azaleas, rhododendrons. Mail-order catalog.
- Jackson & Perkins Co., Box 1028, Medford, Oregon 97501. (503) 779-4521. Retail and wholesale. Roses, spring bulbs. Mail-order catalog.
- Kansas Landscape & Nursery Co., 1416 E. Iron Ave., Salina, Kansas 67401. (913) 827-0051. Retail and wholesale. General nursery stock. Mail-order catalog.
- KE** Kelly Bros. Nurseries, 23 Maple St. Dansville, New York 14437. (716) 987-2211. Retail and wholesale. General nursery stock, fruit and nut trees, bulbs. Mail-order catalog.
- Kingsville Nurseries, H. J. Hohman, Kingsville, Maryland 21087. (301) 592-2931. Retail and wholesale. Rare trees and shrubs, probably the most extensive nursery collection in the country. Especially wide variety of azaleas, maples, flowering cherries, viburnums and conifers. No current catalog. The common practice is to send Mr. Hohman a "want" list, since some plants are in short supply and may take a year or two before available. Visitors by appointment only.
- KI** Rudolph Khuis Nursery, Box 116, Ryan Rd., Marlboro, New Jersey 07746. (201) 462-4694. Retail. Dwarf conifers, hard-to-find shrubs. Catalog 25¢. Does not ship. No deliveries. Visitors by appointment only. Closed on Sunday.
- KN** Joseph J. Kern Rose Nursery, Box 33, Jackson St. & Heisley Rd., Mentor, Ohio 44060. (216) 255-8627. Retail and wholesale. Old and new roses. Rare kinds. Custom budding. Visitors June-October by appointment only. Mail-order catalog.
- Kimberly Barn Floral & Garden Center, 1221 E. Kimberly Rd., Davenport, Iowa 52807. (319) 324-1955. Local retail. General nursery stock.
- KR** Krider Nurseries, Middlebury, Indiana 46540. (219) 825-2181. Retail and wholesale. Fruit trees, ornamental trees and shrubs. Mail-order catalog.
- KS** Kroh Nurseries, Box 536, Rte. 287, Loveland, Colorado 80537. (303) 667-4223. Retail and wholesale. Ornamental trees and shrubs for the Rocky Mountains. Fruit trees. Larger specimens at nursery. Mail-order catalog.
- LA** LaBars' Rhododendron Nursery, Box 111, Bryant St., Stroudsburg, Pennsylvania 18360. (717) 421-5880. Retail and wholesale. Landscape-size trees and shrubs available at the nursery. Mail-order catalog for rhododendrons and other ericaceous plants.
- LC** LaFayette Home Nursery, Box 148, Rte. 17, LaFayette, Illinois 61449. (309) 995-3311. Retail and wholesale. Extensive selection of trees and shrubs, many in large specimen size. Lengthy retail price list. Nursery ships wholesale to other firms; also ships retail if customer so desires.
- Lafkins Garden Center, Mamaroneck Ave. at Rosedale, White Plains, New York 10603. (914) 946-2300. Local retail. General nursery stock.
- LE** Lamb Nurseries, E. 101 Sharp Ave., Spokane, Washington 99202. (509) 328-7956. Dwarf shrubs, rock garden plants, perennials, ground covers, herbs, hardy succulents. Mail-order catalog.
- H. L. Larson, 3656 Bridgeport Way, Tacoma, Washington 98466. (206) 564-1488. Seeds of uncommon rhododendron species. No plants shipped. List.
- A. M. Leonard & Son, Box 816, Piqua, Ohio 45356. (513) 773-2694. Gardening and pruning tools. Extensive catalog.
- Henry Leuthardt Nurseries, Montauk Highway, East Moriches, New York 11940. (516) 878-1387. Dwarf and espaliered fruit trees. Mail-order list.
- LI** Light's Landscape Nurserymen, 9153 East D Ave., Richland, Michigan 49083. (616) 629-9761. Retail and limited wholesale. Unusually wide range of trees and shrubs. Large specimens at nursery. Delivery arranged to various points. Catalog. Ships.
- LN** Linn County Nurseries, 520 Franklin, Center Point, Iowa 52213. (319) 849-1423. Retail and wholesale. General nursery stock for the Plains. Specimen-size trees and shrubs. Garden center. Catalog.
- LT** Littlefield-Wyman Nurseries, 227 Centre Ave. (Rte. 123), Abington, Massa-

- chusetts 02351. (617) 878-1800 (from Boston area call 472-1195.) General nursery and garden center. Landscape-size trees and shrubs, evergreens. Delivery within 20 miles of Abington, beyond by special arrangement. Catalog.
- Baier Lustgarten, Middle Island, New York. See #21 in wholesale list.
- MA May Nursery Co., Box 1312, 212 N. 3rd Ave., Yakima, Washington 98901. (509) 453-8219. Retail and wholesale. Fruit trees, berry plants and other nursery stock. Mail-order catalog.
- MB Earl May Seed & Nursery Co., 100 N. Elm St., Shenandoah, Iowa 51601. (712) 246-1020. Primarily retail. 42 garden centers in Iowa, Nebraska, Missouri and South Dakota. General nursery stock, fruit trees, flower and vegetable seed. Mail-order catalog.
- MD Medford Nursery, Eayrestown - Red Lion Rd., R. D. 1, Medford, New Jersey 08055. (609) 267-8100. Retail and wholesale. General nursery stock, container grown plants and pot grown liners. Hollies. Ships retail.
- MF Mayfair Nurseries, R. D. 2, Nichols, New York 13812 (nursery at Windham, Pa.). (717) 395-3154. Retail and wholesale. Dwarf conifers, heaths, heathers, dwarf rhododendrons and other rock garden plants. Mail-order catalog 25¢.
- MK McKay Nursery Co., 254 Jefferson St., Waterloo, Wisconsin 53594. (414) 478-2121. (Sales offices in Milwaukee and Madison). Retail and wholesale. General nursery stock, specimen-size trees and shrubs. Landscape catalog.
- ML Mellinger's, Inc., 2310 W. S. Range Rd., North Lima, Ohio 44452. (216) 549-2027. Retail. Extensive variety of trees and shrubs in small sizes. Pre-bonsai. Tree seeds. Unusually large list of garden supplies, grafting tools, pruning shears, etc. Reference books. Mail-order catalog.
- MU Musser Forests, Inc., Box 340, Rte. 119, Indiana, Pennsylvania 15701. (412) 465-5686. Conifers in quantity units for Christmas tree plantings and reforestation. Deciduous trees, flowering shrubs. Mail-order catalog.
- Raymond Nelson Nursery, R. D. 3, Dubois, Pennsylvania 15801. (814) 371-3983. Retail and wholesale. Serviceberry trees (*Amelanchier*), evergreens for Christmas tree plantings. Ships.
- NE Neosho Nurseries, Box 550, Neosho, Missouri 64850. (417) 451-1212; also at Fort Smith, Arkansas 72901, (501) 785-2579. Retail and wholesale. General nursery stock, fruit trees. Mail-order catalog.
- NU Nuccio's Nurseries, 3555 Chaney Trail, Altadena, California 91001. (213) 794-3383. Retail. Extensive camellia listing. Azaleas. Nursery closed Wednesdays. Mail-order catalog.
- OL Oliver Nurseries, 1159 Bronson Rd., Fairfield, Connecticut 06430. (203) 259-5609. Retail. Dwarf conifers and rock garden evergreens. Dwarf rhododendrons. Uncommon trees and shrubs. Pre-bonsai plants. Mail-order catalog.
- PA Palette Gardens, 26 W. Zion Hill Rd., Quakertown, Pennsylvania 18951. (215) 536-4027. Dwarf conifers (no catalog), uncommon rock garden perennials (price lists). Will ship conifers and perennials. Best call for appointment, since hours vary.
- PF Panfield Nurseries, 322 Southdown Rd., Huntington, New York 11743. (516) 427-0112. Retail and wholesale. Extensive selection of trees and shrubs, many in specimen size. Heathers, conifers, broad-leaf evergreens. Separate retail and wholesale lists.
- PK Park Gardens, 1435 Huntington Tpke., Trumbull, Connecticut 06611. (203) 374-3103. Retail and wholesale. Dwarf conifers and rock garden shrubs. List available. Ships.
- PR George W. Park Seed Co., Greenwood, South Carolina 29646. (803) 451-3341. Retail and wholesale for vegetable and flower seed, exclusively retail for nursery stock. Small sizes. Mail-order catalog.
- Patmore Nurseries, Brandon, Manitoba, Canada. (204) 727-1371. Retail nursery stock for the Northern Plains. Mail-order catalog.
- Pellett Gardens, Atlantic, Iowa 50022. (712) 243-1917. Honey plants. Mail-order list.
- PT Peters & Wilson Nursery, E. Millbrae Ave. & Rollins Rd., Millbrae, California 94030. (415) 697-5373. Retail and wholesale. Garden center. Closed Wednesdays. Wide selection of ornamental trees and shrubs for southern California. Fruit trees. Catalog \$1.00.
- Pikes Peak Nurseries, Box 670, Indiana, Pennsylvania 15701. (412) 473-7747.

- Retail and wholesale. Evergreens for Christmas tree plantations and reforestation. General nursery stock. Mail-order catalog.
- Pioneer Nursery, Box 665, Rte. 1, Ridgefield, Washington 98642. (206) 887-3420. Retail outlet of Viewcrest Nurseries. See #39 in wholesale list.
- PV Plumfield Nurseries, Box 410, 2105 N. Nye Ave., Fremont, Nebraska 68025. (402) 721-3622. Garden center, 735 W. 23rd St. (Rte. 30) (721-3520). Retail orders handled through garden center, wholesale orders through the nursery. General nursery stock. Separate retail and trade lists.
- Primex Garden Center, 435 W. Glen-side (Montgomery County), Pennsylvania 19038. (215) 887-7500. Local retail. General nursery stock.
- PW Putney Nursery, Putney, Vermont 05346. (802) 387-5577. Retail. Wildflowers, ferns, perennials, ornamental trees and shrubs. Woody plants available only at the nursery. Mail-order catalog.
- PY Perry's Plants, Inc., 19362 Walnut Dr., La Puente, California 91745. (213) 964-1285. Retail and wholesale. Ground covers in quantity units. Catalog.
- RA Rainier Mt. Alpine Gardens, 2007 S. 126th, Seattle, Washington 98168. (206) 242-4090. Retail (wholesale only at nursery). Dwarf conifers, uncommon rhododendrons, rock garden shrubs. Mail-order catalog.
- RF Raraflora, Fred W. Bergman, 1195 Stump Rd., Feasterville, Pennsylvania 19047. (215) 357-3791. Retail. Extensive selection of dwarf conifers. Japanese maples, uncommon trees and shrubs. List available. Will ship, but encourages pick-up at nursery. Visitors by appointment only.
- Rayner Bros., Box 348, Salisbury, Maryland 21801. (301) 742-1594. Retail. Fruit and nut trees, strawberries, other berry plants. Mail-order catalog.
- Herbert Read, Dwarf & Bonsai Plants, 2713 N. Myers St., Burbank California 91504.
- RI Clyde Robin, Box 2091, Castro Valley, California 94546. (415) 581-3467. Retail. Unusual conifers, ornamental trees and shrubs in small sizes. Pre-bonsai. California native plants. Tree and wildflower seeds. Mail-order catalog 50¢.
- RK Rocknoll Nursery, Box 301, Morrow, Ohio 45152. (513) 899-3861. Retail and wholesale. General nursery stock in small sizes. Mail-order catalog.
- RO Rosedale Nurseries, Saw Mill River Parkway, Hawthorne, New York 10532. (914) 769-1300; also, Rosedale - in - Dutchess, Rte. 44, Millbrook, New York 12545, (914) 677-3938. Retail. Large selection of general nursery stock. Shade trees of landscape size. Many plants not in catalog (50¢) are stocked. Does not ship.
- RS Rose Hill Nursery, 2380 W. Larpenteur Ave., St. Paul, Minnesota 55113. (612) 646-7541; also at E. Hennepin & Fulham, Minneapolis. Retail. General stock, fruit trees, berry plants. Catalog. Ships.
- San Gabriel Nursery & Florist, Inc., 632 S. San Gabriel Blvd., San Gabriel, California 91776. (213) 286-3782. Local retail. General nursery stock.
- SA Scarff's Nursery, Rte. 1, New Carlisle, Ohio 45344. (513) 845-2551. Retail and wholesale. General nursery stock.
- Seven Dees Nursery, 6025 S. E. Powell, Portland, Oregon 97206. (503) 777-1412. Retail outlet of Sherwood Nursery Co. See #33 in wholesale list.
- SE A. Shammarello & Son Nursery, 4590 Monticello Blvd., South Euclid, Ohio 44143. (216) 381-2510. Retail and wholesale. Rhododendrons and other broad-leaf evergreens. Mail-order catalog.
- SH Sheridan Nurseries, 100 Sherway Dr., Etobicoke, Ontario, Canada. (416) 259-5095. Sales stations also at Greenhedges, 650 Montée de Liesse, Montreal 377, P. Q. (514-744-2451); Glenpark, 2827 Yonge St., Toronto 317, Ontario; others in Clarkson and Unionville, Ontario. Retail and wholesale. Wide selection of general nursery stock, perennials, roses. Deliveries in Toronto-Hamilton and Metropolitan Montreal. Catalog. Ships.
- The Shop in the Sierras, Carl Stephens, Box 1, Midpines, California 95345. Western native trees and shrubs. Mail-order catalog 25¢.
- SI Silver Falls Nursery & Christmas Tree Farm, Silver Falls Highway, Star Route, Box 55, Silverton, Oregon 97381. (503) 873-4945. Retail. Large selection of unusual conifers, shrubs and trees, western native plants. Small sizes, many plants suited for bonsai initiation. Mail-

- order catalog.
- SN Francis M. Sinclair, R. F. D. 1, Newmarket Rd., Exeter, New Hampshire 03833. (603) 772-2362. Quantity dealer in wildflowers, native trees and shrubs. Material collected from the wild. Price list. Ships.
- SO Siskiyou Rare Plant Nursery, 522 Franquette St., Medford, Oregon 97501. Retail. Dwarf shrubs, rare alpine plants. Mail-order catalog 50¢.
- SP Joel W. Spingarn, 1535 Forest Ave., Baldwin, New York 11510. (516) 623-7810. Retail. Extensive selection of dwarf conifers. Japanese maples, rock garden rhododendrons. List 25¢. Ships. Visitors by appointment only.
- SQ Squirrel Hill Nursery, 2945 Beechwood Blvd., Pittsburgh, Pennsylvania 15217. (412) 421-1900. Retail and wholesale. General nursery stock. Catalog. Does not ship. Delivery arranged in greater Pittsburgh area.
- SR Spring Hill Nurseries, Elm St., Tipp City, Ohio 45371. (513) 667-2491. Retail and wholesale. General stock, perennials, ground covers, vines. Mail-order catalog.
- SS Star Roses (Conard-Pyle Co.), West Grove, Pennsylvania 19390. (215) 869-2426. Retail mail order catalog limited to roses. Garden centers in West Grove and Lancaster offer a wide range of shrubs and trees, besides roses. Wholesale catalog for roses and general stock.
- ST Stark Bro's Nurseries & Orchards Co., Louisiana, Missouri 63353. (314) 754-5511. Retail. Large selection of fruit trees. Ornamental shrubs and trees. Mail-order catalog.
- Styer's Garden Center, Box 37, Rte. 1, Concordville, Pennsylvania 19331. (215) 459-3479. Retail and wholesale. General nursery stock. Does not ship.
- Sylvan Nursery, 1028 Horseneck Rd., South Westport, Massachusetts 02790. (617) 636-4573. Retail. Heaths, heathers, seashore plants. List. Ships.
- TE Tennessee Nursery Co., Box 1299, Cleveland, Tennessee 37311. (615) 476-4142. Retail. General nursery stock. Mail-order catalog.
- TH Thomasville Nurseries, Box 7, 1842 Smith Ave., Thomasville, Georgia 31792. (912) 226-5568. Retail. Camellias, roses, daylilies, liriopes. Mail-order catalog.
- TI Tillotson's Roses, 992 Brown's Valley Rd., Watsonville, California 95076. (408) 724-3537. Retail, with discount for quantity purchase. Extensive selection of old-fashioned and modern roses. Catalog \$1, deductible on first order.
- Tomlinson's Nursery, 11758 E. Whittier Blvd., Whittier, California 90601. (213) 693-9234. Retail outlet of Select Nurseries. See #30 in wholesale list.
- William Tricker, Inc., 174 Allendale Ave., Saddle River, New Jersey 07458. (201) 327-0721; also, 7125 Tanglewood Dr., Independence, Ohio 44131, (216) 524-2430. Water lilies and bog plants. Mail-order catalog.
- VA Valley Nursery, Box 845, 2801 N. Montana, Helena, Montana 59601. (406) 442-8460. Retail and wholesale. Uncommon trees and shrubs for cold climates. Seedlings in quantity units. Price list. Ships.
- Marinus Vander Pol, 776 Washington St., Fairhaven, Massachusetts 02719. (617) 992-0330. Retail and wholesale. General nursery stock. Mail-order climatis catalog 35¢.
- VI Martin Viette Nurseries, Rte. 25A (Northern Blvd.), East Norwich, New York 11732. (516) 922-5530. Retail and wholesale. Extensive nursery stock, including an unusually wide range of perennials and wildflowers. Catalog 50¢. Does not ship.
- WA Watnong Nursery, The Don Smiths, Morris Plains, New Jersey 07950. (201) 539-0312. Retail. Extensive selection of dwarf evergreens, rare shrubs and trees. Container-grown. Availability lists. Does not ship. Open by appointment only.
- WB Waynesboro Nurseries, Box 987, Lyndhurst-Sherando Lake Rd., Waynesboro, Virginia 22980. (703) 942-4141. Retail and wholesale. General nursery stock, fruit trees, berry plants. Smaller trees and shrubs shipped, larger ones at the nursery. Mail-order catalog.
- WE Weall and Cullen Nurseries, 784 Shepard Ave. E., Willowdale, Ontario, Canada. (416) 225-7705. Other Metropolitan Toronto garden centers at 1774 Ellesmere Rd., Scarborough, Ont. (416-291-1931) and Highway 27, R. R. 3, Woodbridge, Ont. (416-851-2281). General nursery stock, garden supplies. Mail-order catalog.

Western Maine Forest Nursery Co., 36 Elm St., Fryeburg, Maine 04037. (207) 935-2165. Retail and wholesale. Small-size conifers in quantity units for Christmas tree plantations and reforestation. Mail-order price list.

WF White Flower Farm, Rte. 63, Litchfield Connecticut 06759. (203) 567-9415. Retail. Perennials, bulbs, uncommon trees and shrubs. Mail-order catalog \$1.50.

WG Wayside Gardens, 9470 Mentor Ave., Mentor, Ohio 44060. (216) 357-7538. Retail and wholesale. Wide range of trees, shrubs, vines, roses, perennials, bulbs. Mail-order catalog \$2.00, refundable on first purchase.

WI The Wild Garden, George Schenk, 8243 N. E. 119th, Kirkland, Washington 98033. Retail and wholesale. Large variety of hard-to-find rock garden plants. Ericaceous plants. Catalog \$1, deductible on first purchase. Catalog supplement 25¢. Mail-order sales only.

WN Weston Nurseries, E. Main St., Hopkinton, Massachusetts 01748. (617) 435-3414 (from Greater Boston, Wellesley

235-3431). Retail and wholesale. General nursery stock, roses, perennials. Catalog free to New England, \$1 elsewhere. Plants not shipped parcel post or express. Truck delivery on large orders may be arranged to various New England points.

Windsor Road Nursery, Rte. 12A, Claremont, New Hampshire. (Mailing address: RFD 2, Windsor, Vermont 05089.) (603) 543-3239. General nursery stock, roses.

WO Wolf's Holly Orchard, Box 636, Millville, New Jersey 08332. (609) 825-4959. Retail and wholesale. Rooted cuttings shipped, but larger hollies must be picked up at the nursery. Cut holly in the Christmas season. Price list.

WY Melvin E. Wyant Rose Specialist, Rte. 84 (Johnny Cake Ridge), Mentor, Ohio 44060. (216) 255-2553. Retail and wholesale. Old-fashioned and new roses. Mail-order price list.

ZI Zilke Brothers Nursery, Box 8, Baroda, Michigan 49101. (616) 422-1651. General stock, fruit trees, berry plants. Mail-order catalog.

Importing Nursery Stock from Overseas

GARDENERS in the U.S. and Canada may order plants from overseas nurseries, although obviously there is some risk involved. The plants must enter in bare-root condition—free from soil or leafmold, although certain kinds of packing materials such as sphagnum moss are permitted. Also, the plants may be in transit for a long period, depending on method of transportation and on the nursery's country as well as the plants' final destination. Authorized inspection stations exist at J.F.K. International Airport, New York, and at Hoboken, N.J. Other stations are at Miami, Fla.; New Orleans, La.; Brownsville, El Paso and Laredo, Texas; Nogales, Arizona; San Diego, San Francisco and San Pedro, Calif.; Seattle, Wash.; San Juan, Puerto Rico; and Honolulu, Hawaii. The gardener should check first with the overseas nursery to be sure it is willing to ship, then write to the U.S. Dept. of Agriculture, Agricultural Research Service, Plant Quarantine Division, 209 River St., Hoboken, N.J. 07030, giving names of plants he wishes to import. If permission is given, the gardener will receive a permit and import labels addressed to the inspection station for the use of the overseas shipper on each package. The inspection station may also provide the importer with instructions to pass on to the shipper. Canadians who wish to import plants should write to the Plant Protection Division, Dept. of Agriculture, Ottawa. Information on importing plants from Canada (or from the U.S. to Canada), a generally less complicated process, can be obtained from the U.S. and Canadian addresses given above.

WHOLESALE NURSERIES

The following firms are not equipped to deal directly with the gardening public, except where noted. This list is primarily for nurserymen. If you desire a plant that is

available only from a wholesale source, please ask your local nurseryman to order it for you.

- 1 Appalachian Nurseries, Box 87, Fairview Ave., Waynesboro, Pennsylvania 17268. (716) 762-4733, 762-4312. Lining out stock of uncommon shrubs and trees. Azaleas and rhododendrons. Catalog and nursery aid brochures.
- 2 Bagatelle Nursery, Box 606, Center Moriches, New York 11934. (516) 878-1717. Nursery at Head of the Neck Rd., East Moriches. General stock.
- 3 Cherry Hill Nurseries, Main Office, Cherry Hill St., W. Newbury, Massachusetts 01985. (617) 462-6688. Wholesale division on Rte. 113, Newburyport, retail at W. Newbury address. No retail mail-orders. General stock, roses, peonies.
- 4 J. Clarke Nursery Co., Box 343, Trimble Rd., San Jose, California 95103. (408) 263-1313. Flowering cherries and crab apples, broad-leaf evergreens, lilacs, flowering quinces, wisterias. Tree roses.
- 5 Cole Nursery Co., R. D. 1, Rte. 1, Circleville, Ohio 43113. (614) 474-7531. Shade trees, flowering trees and shrubs.
- 6 Corliss Bros., Inc., Wholesale Division, Reynard St., Gloucester, Massachusetts 01930. (617) 283-0512. Also, retail garden center on Essex Rd., Ipswich, Mass. 01938, (617) 356-5422. No retail mail order. General nursery stock, Emerald Series euonymus.
- 7 Curtis Nurseries, Bridge St., Callicoon, New York 12723. (914) 887-4400. General nursery stock, native azaleas and hemlocks.
- 8 Environmental, James E. Cross, Box 824, Cutchogue, New York 11935. (516) 734-6439. Box huckleberry and other dwarf broad-leaf evergreens. Dwarf conifers. Container stock. Does not ship.
- 9 F & F Nurseries, Box 362, Crawford's Corner Rd., Holmdel, New Jersey 07733. (201) 946-4500. General stock, lilacs, yews.
- 10 Fairview Evergreen Nurseries, Box E, 131 E. Water St., Fairview, Pennsylvania 16415. (814) 474-5712. Conifers, ornamental trees and shrubs.
- 11 Forest Nursery Co., R.F.D. 2, Highway 56, McMinnville, Tennessee 37110. (615) 473-2133. Ornamental trees and shrubs, fruit trees, container stock.
- 12 Glen Saint Mary Nursery Co., State Rte. 125, Glen Saint Mary, Florida 32040. (904) 259-4931. Hollies, Junipers, palms, bamboos, figs and other fruit trees. Mild climate plants. Container stock.
- 13 Goochland Nurseries, Highway 17, Pembroke, Florida 33866. (813) 285-8141. Warm-climate trees and shrubs. Container stock. Retail mail-order list only for house plants.
Gro-Plant Industries, Simpson Nurseries, Box 160, Monticello, Florida 32344. (904) 977-2516. General stock, fruit trees. Container grown trees and shrubs, B & B and pre-packaged plants for garden centers.
- 14 Calvin Harman Nursery, Stovall, Georgia 30283. (404) 884-8838, 882-1029. Rooted cuttings and liners of evergreen shrubs. Japanese hollies. Some B & B stock.
- 15 Hess' Nurseries, Box 332, Rte. 553, Cedarville, New Jersey 08311. (609) 447-4213. Seedlings of uncommon trees and shrubs. Grafts of hard-to-find conifers. Pre-bonsai plants. B & B material.
- 16 D. Hill Nursery Co., Box 8, Dundee, Illinois 60118. (312) 426-3451. Conifers, general nursery stock, ground covers and vines.
- 17 Hollandia Gardens, 10725-39th Ave. N. E., Seattle, Washington 98125. (206) 363-6080. Rare trees and shrubs. B & B and container stock.
- 19 Imperial Nurseries, Box 130, Pigeon Hill Rd., Windsor, Connecticut 06095. (203) 688-5271. Evergreens, azaleas,

- deciduous trees and shrubs. Container stock.
- 20 Ingleside Plantation Nurseries, Oak Grove, Virginia 22443. (703) 224-2042. General nursery stock, broad-leaf evergreens. Catalog \$1, available only to the trade.
- 21 Baier Lustgarten, Jericho Tpke., Middle Island, New York 11953. (516) 924-3444. Extensive list of trees and shrubs. Specimen material. Local retail as well as wholesale to various points.
- 22 Millcreek Nursery, Corner Ketch, Rte. 3, Newark, Delaware 19711. (302) 239-5257. Rare trees and shrubs. Does not ship.
- 23 Mitsch Nursery, Aurora, Oregon 97002. (503) 266-9652. Lining out stock of conifers, rhododendrons, camellias, heaths and heathers, miscellaneous broad-leaf evergreens. Wide selection.
Monrovia Nursery Co. See #44.
- 24 Mountain Home Nurseries, Box 26, DeBorgia, Montana 59830. (406) 678-4221. Christmas tree seedlings.
Phytoecology, Ltd., Box 303, Ridgeley, Maryland 21660. Dwarf conifers, rhododendrons, hard-to-find trees and shrubs.
- 25 Phytotektor, Inc., Carl Bauer, Box 99, Winchester, Tennessee 37398. (615) 967-2432. Rooted cuttings and liners of flowering quinces, hollies, junipers. Uncommon plants.
- 26 Pioneer Growers, 1848 Warmlands Ave., Vista, California 92083. (714) 724-1398. Liners of warm climate trees and shrubs.
- 28 Princeton Nurseries, Box 191, Princeton New Jersey 08540. (609) 924-1776. General nursery stock. Catalog \$1, available only to the trade.
- 29 Edward H. Scanlon & Assoc., 7621 Lewis Rd., Olmsted Falls, Ohio 44138. (216) 235-3314. Street trees selected for special growth habits. Uncommon trees, flowering cherries, crab apples.
- 30 Select Nurseries, 12831 E. Central Ave., Brea, California 92621. (714) 529-3711, (213) 697-7268. Large selection of general nursery stock for mild climates. Container grown material. Catalog \$3, available only to the trade.
- 31 Shenandoah Nurseries, Box 99, 301 Wabash Ave., Shenandoah, Iowa 51601. (712) 246-3563. General stock, fruit trees, berry plants, roses, peonies.
- 32 Sherman Nursery Co., Box 520, 1300 Grove St., Charles City, Iowa 50616. (515) 228-1124. Shade trees, crab apples, flowering shrubs, fruit trees and vines.
- 33 Sherwood Nursery Co., Main Office, 13020 N. E. Rose Parkway, Portland, Oregon 97230. (503) 255-9619. Nursery located at Gresham, Ore., (503) 663-3709. Conifers, rhododendrons and other broad-leaf evergreens. Uncommon shrubs.
- 34 Simpson Orchard Co., 1504 Wheatland Rd., Vincennes, Indiana 47591. (812) 822-2441. Hollies, crab apples, hawthorns.
- 35 Summer Hill Nursery, Summer Hill Rd., Madison, Connecticut 06443. (203) 245-9097. General nursery stock, conifers, rhododendrons. B & B and container stock.
- 36 Tingle Nursery Co., Pittsville, Maryland 21850. (301) 835-3001. Wide range of trees and shrubs. Azaleas, hollies. Lining out and specimen stock.
- 37 Van Veen Nursery, 4201 S. E. Franklin St., Portland, Oregon 97206. (503) 771-6712. Large selection of rhododendrons. Catalog 25¢.
Verkade's Nurseries, 262 Black Oak Ridge Rd., Wayne, New Jersey 07470. (201) 694-0304. Uncommon conifers in small sizes.
- 38 John Vermeulen & Son, Inc., Box 267N, Woodfern Rd., Neshanic Station, New Jersey 08853. (201) 369-5211. Liners and container stock of uncommon trees and shrubs. Dwarf conifers, azaleas, broad-leaf evergreens. Pre-bonsai and bonsai. Unrooted cuttings and scions. Landscape material.
- 39 Viewcrest Nurseries, 9617 N. E. Burton Rd., Vancouver, Washington 98662. (206) 892-4942, 892-2244. Seedlings and transplants of shade and flowering trees.
- 40 Westbrook Associates, Box 358, Greenlawn, New York 11740. (516) 261-2333, 261-2080. Nurseries at 33 Stony Hollow Rd., Centerport, N. Y. General nursery stock. Container plants.
- 41 Westminster Nurseries, Box 227, Westminster, Maryland 21157. (301) 848-9444. Conifers, hollies and other broad-leaf evergreens. Flowering trees and shrubs.
- 42 Alfred Teufel Nursery, 12345 N. W. Barnes Rd., Portland, Oregon 97229.

- (503) 646-1111. General stock. Broad-leaf evergreens, including hollies. Ground covers. Fruit trees. Nursery and greenhouse supplies.
- 43 Gardena Valley Nursery Growers, 16420 S. Avalon Blvd., Gardena, California 90247. (213) 324-4409. Co-operative unit of 24 growers. (Eastern representative: Bernard Gilson, Rte. 25A & Edgewood Ave., St. James, New York 11780. (516) 584-5360. Warm-climate plants, broad-leaf evergreens, ground covers. Container stock and liners.
- 44 Monrovia Nursery Co., Box Q, 18331 E. Foothill Blvd., Azusa, California 91702. (213) 334-9321. Unusually wide range of general nursery stock for moderate as well as mild climates. Container stock, also smaller sizes. Catalog \$3, available only to the trade.
- 45 Bosley Nurseries, 9579 Mentor Ave., Mentor, Ohio 44060. (216) 352-3308. Hollies, ericaceous plants. Flowering shrubs. Container stock.
- 46 K. M. Nursery, Box 847, 5154 Foothill Rd., Carpinteria, California 93013. (805) 684-2318. Mild climate trees and shrubs.
- 47 Warren County Nursery, Box 153A, Rte. 2, McMinnville, Tennessee 37110. (615) 668-8941. General nursery stock, fruit and nut trees.



Roche

An invitation to wander is provided by this yew hedge and arch. There are many, many forms of yew, making it one of the most versatile among all evergreens.

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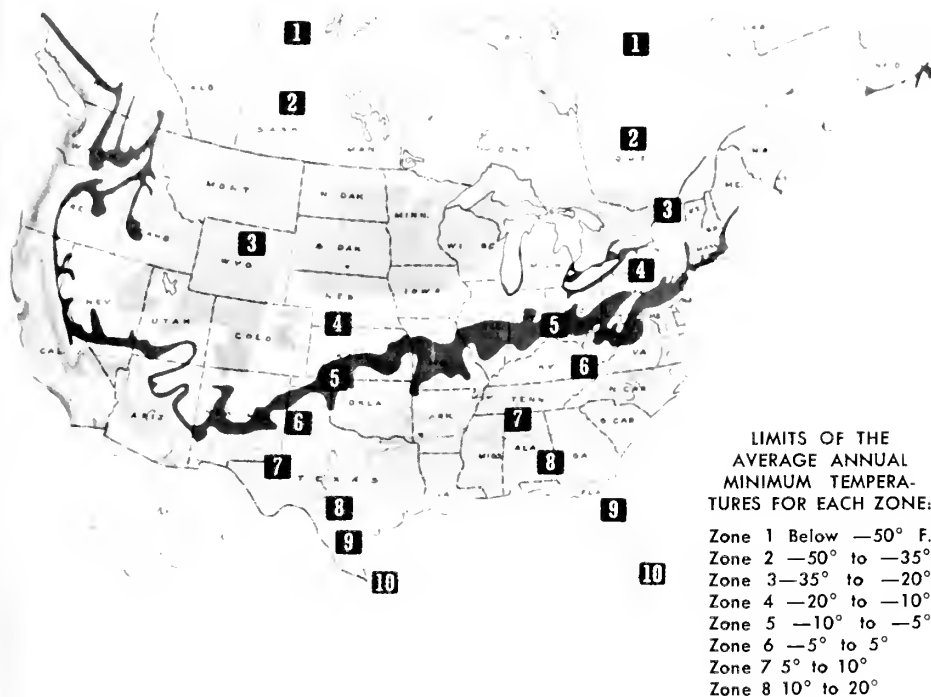
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NOTES

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For a list of topics see back cover.



Gottcho-Schleiss

A section of the Japanese garden at the Brooklyn Botanic Garden in spring.

BROOKLYN BOTANIC GARDEN

America's botanic gardens and arboreta have always been concerned about the environment and ecology. Now, dealing with environmental and ecological problems has become a popular cause for every man with the encouraging result that Earth Day celebrations are no longer limited to action for special days but have become yearlong activities. With this Handbook, Editor Frederick McGourty, Jr., Associate Editor Marjorie J. Dietz and Diana Miller of the Brooklyn Botanic Garden staff have brought together some 200 centers throughout the United States and Canada where environmental information is readily available to everyone.

At the 25th American Horticultural Congress the following statements were presented which help to explain the role played by botanic gardens and arboreta in today's society:

"They are usually near centers of large populations."

"They present a continuing, year-round service of display and education in horticulture and botany."

"Among themselves, they freely exchange new ideas in horticultural techniques and plant materials."

"They offer information about plants for people of all ages through special educational classes."

"They are the reservoir for vast quantities of seeds, plants and traditions of landscaping situations and uses."

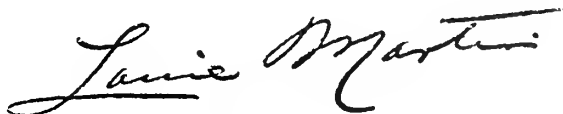
"They are often the only source of propagation material of old cultivars or species of plants."

"So popular and so successful have botanic gardens and arboreta become, so thorough have their records of contributions been in their neighborhoods that, as the current rush to the suburbs from the crowded cities continues, more and more citizens who are concerned with new city developments are recognizing the necessity of such cultural assistance in attracting permanent urban residents."

Brooklyn Botanic Garden, long a supporter of the botanic garden and arboreta movement in the United States, hopes that you, the reader and you, the traveler, will be guided by this Handbook to visit as many of the gardens listed as possible. Enjoy their beauty and the carefully planned arrangements of plants and seasonal displays. Enroll in classes or become members of one of the gardens so your own garden, large or small, can bring you more pleasure. After your first exploring visit, take a friend the second time, someone who has yet to be introduced to this great green world.

A word or two of explanation about the listings in this Handbook. Readers will notice that in many entries there is a second number in parentheses after mention of the number of members on a garden staff. This latter number refers to the total staff in summer, as opposed to year-round workers. Also, according to the information received by the Editor, the gardens cited in the major entries have collections that are generally labeled, unless otherwise stated.

Remember, every day is Earth Day at a botanic garden or arboretum.



Director

AMERICAN GARDENS— A TRAVELER'S GUIDE

INTRODUCTION

Frederick McGourty, Jr.

THE 200 gardens which are described in this Handbook are a varied group. The majority are botanic or botanical (in common usage the difference in the two words is merely one of spelling) gardens or arboreta, while some are estate or plantation gardens, and a few are nature preserves. Still others are commercial enterprises. They range in size from $\frac{1}{4}$ to 10,000 acres. All of them, regardless of their diverse origins, are places of beauty and harmony in a changing environment. At a time when interest in ecology is high, it might be noted that every day is Earth Day at each of these gardens.

It is hoped that this Handbook will make the travels of American gardeners more enjoyable.

Readers with more than a passing horticultural interest may want to write ahead for brochures to the gardens they plan to visit. Such publications will give more specific information (*e. g.*, bloom dates, maps) than can be incorporated in this guide. (Gardens which offer brochures are so credited in their entries. Enclose a stamped and self-addressed business-size envelope when making requests.)

The face of a garden has different expressions according to the seasons, and the regular visitor will see many forms of beauty in the course of a year. Except for the Deep South and California, most gardens are at their flowering peak in late April and the month of May, when they become places of memorable beauty. However, the best-known gardens may then be quite crowded with visitors. (In the case of the Brooklyn Botanic Garden, as many as 40,000 people come to see the Japanese flowering cherries on a pleasant Sunday in the last week of April or the first week

of May.) Naturally, when possible, during the peak season, it is worthwhile to make a weekday visit to such gardens. Even then, a morning or early-evening visit may provide the most enjoyment. On weekends, this is an especially good precaution.

Many gardens are of interest in summer for their displays of annuals, perennials and water-lilies. In cooler parts of the country, where autumn foliage color is normally good, gardens and arboreta (or arboretums, the plural ending being one of choice) with substantial tree and shrub collections have a second "peak" season. Those with large numbers of maples and oaks are usually spectacular in autumn. If there are many exotic trees, especially maples of Oriental origin, the season of fall color will be prolonged, for such trees are apt to change foliage about two weeks later than native ones.

Winter is often overlooked as a time for arboretum visiting, but in most parts of the country there are enough mild days to make such visits feasible. Such trips may be as rewarding as spring ones as sources of ideas for home gardens. Deciduous trees are leafless for six or seven months of the year in the North. Some of them have much more winter character than others, and in view of the long time a gardener must live with trees in their dormant stage, it is wise to seek out those with silhouettes that do not tire the eye.

Readers who may wonder about nearby accommodations in connection with gardens located in rural areas will find a note concerning them in the Handbook. Street or route directions are also given, although in a few instances, this information was not provided to the editor by

the gardens concerned. Often picnic lunches can be pleasurable as well as time-saving, and when permitted by the gardens, mention has been included in their entries. Similarly, there is mention of restaurants or snack bars on the premises or nearby.

Travel Guides and Information

Many readers will be interested in receiving maps, motel lists and other tourist information from the various state travel organizations, which are listed on page 102. Two additional addresses for road maps: Gulf Tourguide Bureau, Box 8056, Philadelphia, Pa. 19101; Texaco Touring Center, 135 E. 42nd St., New York, N.Y. 10017.

The seven regional *Mobil Travel Guides* are helpful motoring aids and, besides listing accommodations and restaurants, they give brief information on some of the smaller gardens that could not be included in the Handbook. The AAA (Automobile Club of America) *Tour Book* series, available to members of that organization, is also a useful guide.

Another book of interest to travelers



Unless otherwise noted, gardens with major entries in this Handbook have labeled their plants. Typical plant label, above, is at National Arboretum, D.C.

is Lonis H. Frohman's and Jean Elliot's *A Pictorial Guide to American Gardens* (New York: Crown Publishers, 1960). While out of print, it may occasionally be found in second-hand bookstores. Still in print is Donald Wyman's *The Arboreta and Botanical Gardens of North America*, a 70-page soft-cover directory available for \$1.50 from the Arnold Arboretum, Jamaica Plain, Massachusetts 02130. It was published in 1959.

Inveterate travelers may also wish to turn to the *International Directory of Botanical Gardens II*, a 206-page soft-cover book available for \$9 from the International Association of Plant Taxonomy, Tweede Transitorium, Uithof, Utrecht, Netherlands. It is intended for the professional botanist, but there is much in it for the globe-trotting gardener as well. In this connection, horticultural travelers might be reminded of Brooklyn Botanic Garden Handbook No. 33, *GARDENS OF WESTERN EUROPE*, guest-edited by Dr. Frederick G. Meyer of the National Arboretum. A copy may be obtained from the Garden for \$1.

For those seeking information on horticultural societies, garden clubs, plant societies, extension services and similar organizations, the *Directory of American Horticulture* (American Horticultural Society, 1971) will be most helpful. Available from Society headquarters, 901, N. Washington St., Alexandria, Va. 22314, for \$5.

Establishing a Botanic Garden

From time to time, institutions such as the Brooklyn Botanic Garden receive requests for general information on how to start an arboretum or botanic garden. Such queries are frequently difficult—sometimes impossible—to answer in the confines of a letter. There is only one book of practical tips for arboretum-planning, but fortunately it is a good one—Fred Lape's *Garden of Trees and Shrubs* (Ithaca: Cornell University Press, 1965). Readers may wish to turn to it as a preliminary to other sources of information.

Such readers should also be in touch with the American Association of Botan-



Haskell

Saucer magnolia (*Magnolia soulangiana*), Mount Auburn Cemetery, Cambridge.

ical Gardens and Arboreta. The information contained in its quarterly *Arboretum and Botanical Garden Bulletin* may be especially helpful. Back copies are usually available. Of special interest: the April and July 1970 issues, which are in part devoted to reprints on arboretum-starting. Particulars about membership in this organization are available from Dr. Fred B. Widmoyer, Secretary-Treasurer, Dept. of Horticulture, New Mexico State University, Las Cruces, N.M. 88001.

A majority of the gardens in *AMERICAN GARDENS: A TRAVELER'S GUIDE* are membership organizations, dependent in different degrees upon the financial support of individual citizens. Regular membership dues generally range from \$2 to \$15 per year and permit these gardens to carry on activities, usually of a direct or indirect educational nature, that go be-

yond the bounds of mere garden maintenance. Such gardens often print a newsletter or other publication for their members. According to their size and to the role of membership, they may also have a special plant information service, library facilities for members, and in some cases may even make available occasional seed or plant "dividends."

Regardless of the privileges that may be enjoyed through membership, the essential point is that members are contributing something directly helpful in making contemporary life more beautiful and rewarding. This is true throughout America, and especially so in urban areas, where gardens are islands of grace and sanctuary in surroundings that have become turbulent in recent years. May these islands become more numerous and merge as continents as time goes by. ♦

American Gardens—A Traveler's Guide

THE NORTHEAST CONNECTICUT

New London. Connecticut Arboretum Connecticut College, New London, Connecticut 06320. Founded 1931. Operated by Botany Department (202-442-5391, Arboretum Ext.) with support from College and Arboretum Association, a membership organization. Instruction and field trips for children (groups) and adults are offered by the associated Thames Science Center, on Arboretum land at 622 Williams St. (Gallows Lane). Brochure. *Bulletin Series* at College Bookshop.

Hours Dawn-dusk. **Area** 370 acres.

Kinds of plants 375 woody species native to Northeast. *Trail Guide* (*Bulletin* No. 16) helps identify the plants in Arboretum, which are not labeled. A woodland arboretum, with stress on ecological studies. Collections: hawthorn, holly, heath, viburnum.

Directions Arboretum is on Williams St., immediately west of College campus. Just east of the campus is a small landscape garden, the **Caroline Black Botanical Garden** (plants unlabeled).

Stamford. Bartlett Arboretum 151 Brookdale Rd., Stamford, Connecticut 06903 (203-322-6971). Established 1965 (formerly private estate). Operated by College of Agriculture of University of Connecticut with partial financial support from Bartlett Arboretum Association membership. Brochure. Adult education program (credit and non-credit courses). Guided tours. Educational displays.

Hours Dawn-dusk. **Area** 62 acres. Staff of 6. **Kinds of woody plants** 250. Collections: conifer, rhododendron and azalea; trees and shrubs grown for their purple or golden leaves. Special gardens: dwarf conifer; pollarded tree area. Bog walk. Specimen trees: Japanese umbrella-pine (*Sciadopitys verticillata*); *Stewartia*

koreana; columnar sugar maple (*Acer saccharum* 'Newton Sentry').

Directions From Merritt Parkway Exit 35, proceed north on High Ridge Rd. (Rte. 137) 1.6 miles to Brookdale Rd. Turn left on Brookdale. Arboretum located 7 miles north of Stamford. High Ridge Rd. bus from center (hourly). From New York City, 1¼-hour drive.

Other Connecticut gardens: **Rose Garden** in Elizabeth Park, Prospect and Asylum Aves., Hartford. **Test plots** for annuals, University of Connecticut campus, Rte. 195, Storrs.

MASSACHUSETTS

Cambridge (Boston). Mount Auburn Cemetery 580 Mount Auburn St., Cambridge, Massachusetts 02134 (617-547-7105). Established 1831. Private corporation. Nation's oldest "garden cemetery," founded under auspices of Massachusetts Horticultural Society. Brochure.

Hours 8 A.M.-7 P.M. daily (winter 8 A.M.-sunset). **Area** 165 acres. Staff of 40 (80 in summer). A mature arboretum with more than 1,000 labeled trees, some over 100 years old. Notable specimens of copper, cut-leaf and weeping beeches; sugar, Norway and Schwedler Norway maples; black, red and scarlet oaks. Stands of Kentucky coffee-tree (*Gymnocladus dioica*) and bald-cypress (*Taxodium distichum*). Dogwoods, crabapples, Japanese flowering cherries (58 cultivars).

Uncommon trees: Turkish hazelnut (*Corylus colurna*); cork-tree (*Phellodendron japonicum*); *Stewartia koreana*; lace-bark pine (*Pinus bungeana*); Japanese umbrella-pine (*Sciadopitys verticillata*). Saw-tooth oaks (*Quercus acutissima*) have replaced avenues of American elms. Cemetery is burial place for many famous people.

Directions Cemetery is 1 mile west of Harvard Square in Cambridge. Public transportation from downtown Boston by M.T.A. (rapid transit).

Jamaica Plain (Boston). Arnold Arboretum The Arborway, Jamaica Plain, Massachusetts 02130 (617-524-1717). Founded 1872, on land owned by the City of Boston and leased to Harvard University for 1,000 years. Financed by Harvard, with support from Arboretum membership society. Folder 25 cents by mail, free at entrance. Booklet, *Through the Arboretum*, \$1. Subscription to *Arnoldia* (six issues yearly), \$3.50.

Adult classes and lectures. Guided tours arranged in advance for 25 or more. Near-by restaurant (Howard Johnson's). Picnic facilities in Franklin Park, 1/2 mile east of Arboretum on Rtes. 3, 28.

Hours Sunrise-sunset daily. Cars permitted 9 A.M.-5 P.M. (apply for permit at administration building near main entrance). **Area** 265 acres. Staff of 26.

One of the most extensive collections of mature woody plants in North America. About 6,000 kinds of trees and shrubs. Arboretum is noted for over 500 introductions of plants to cultivation, many by founding director C. S. Sargent and plant explorer E. H. Wilson. Some trees in the Arboretum are the oldest of their kind in the country. Many fine specimen trees, including katsura-tree (*Cercidiphyllum japonicum*); golden-larch (*Pseudolarix amabilis*); Sargent weeping hemlock (*Tsuga canadensis* 'Pendula'); Carolina hemlock. Especially large collections: conifer; crab-apple; lilac; rhododendron and azalea; mock-orange (*Philadelphus*); honeysuckle (*Lonicera*); viburnum.

Of special interest: flowering-shrub beds; dwarf conifer area; bonsai. Peak displays: May-June, flowering shrubs; October, autumn color. Guided spring and autumn walks, Fridays 10 A.M.-12 noon. Propagation and research greenhouses open Wednesday afternoons.

Directions Arboretum located 4 miles southwest of downtown Boston. By car, south on Rte. 1, then left on Rtes. 3, 28. Main entrance is 200 yards from above intersection. Public transportation: Subway (Forest Hills elevated station). Also, Arborway surface car (MBTA) to Soldiers' Monument stop. Short walk from

either point.

See also Weston, Mass. Case Estates of the Arnold Arboretum.

Northhampton. Botanical Garden Smith College, College Lane, Northampton, Massachusetts 01060 (413-584-2700, Greenhouse Ext. 373). Established 1893. Privately endowed. Brochure on request.

Hours Greenhouse 8 A.M.-5 P.M.; arboretum open continuously. The Botanical Garden is essentially the 200-acre Smith Campus. Staff of 16. **Kinds of plants** 3,600. Outstanding specimen trees: American elm; London plane; white willow (*Salix alba*); pond-cypress (*Taxodium ascendens*); metasequoia. Peak display of bulbs in March (greenhouse); rock garden, May-June; perennial borders, spring-summer; and greenhouse chrysanthemums in November.

Directions Garden is in Northampton, off Elm St., 20 miles north of Springfield.

Sandwich. Heritage Plantation of Sandwich Grove and Pine Sts., Sandwich, Massachusetts 02563 (617-888-0352). Established 1969, on estate formerly owned by rhododendron hybridizer Charles O. Dexter, with plantings dating to 1923. Privately endowed. Admission: Adults \$1.50; children under 12, 75 cents. Brochure. Guided tours for groups by appointment. Film available for lectures. Several museum buildings of Americana (automobiles, military equipment). Picnic area. Restaurant and motels nearby.

Hours 10 A.M.-5 P.M., May 1 to mid-October. **Area** 76 acres. Staff of 29. Special collections: original Dexter rhododendrons; flowering trees and shrubs hardy in Cape Cod area. Peak display from mid-May through June. Nature trails planned.

Directions Heritage Plantation is 50 miles south of Boston via Rte. 3 to Cape Cod Canal. Cross Canal at Sagamore Bridge, turn off at first exit, 6-A. Proceed 2 miles to Rte. 130, turn right and follow signs.



Arnold Arboretum

Spring and winter at the Arnold Arboretum, Jamaica Plain, Massachusetts. Above: Flame azaleas (*Rhododendron calendulaceum*) in woodland. Right: Conifer collection.





Naturalized rhododendron plantings, Heritage Plantation of Sandwich, Cape Cod.

Stockbridge. Berkshire Garden Center Stockbridge, Massachusetts 01262 (413-298-5530). Founded 1934. Financial support from membership society. Brochure. *Cuttings*, quarterly publication for members. Children's and adult education programs. Tours. Gift shop. Picnic area.

Hours Dawn-dusk. **Area** 15 acres (8 cultivated). Summer staff of 10. Areas of special interest: herb and rose gardens; extensive perennial border; grass trial plots; lath house for tuberous begonias. Day-lilies. Peak garden display is last two weeks of May, but flower borders are of continuing interest through summer. Small greenhouse. Cactus. Specimen trees: sugar maples.

Directions Garden Center is at junction of Rtes. 102 and 183, 2 miles northwest of Stockbridge.

Also in Stockbridge: Naumkeag (former Choate estate), with formal garden terraces. Open in summer months. Follow signs from center of Stockbridge.

Tanglewood Music Center (Lenox) Attractively landscaped with old trees. A

five-minute drive north of Berkshire Garden Center on Rte. 183.

Wellesley. Walter Hunnewell Pinetum 845 Washington St., Wellesley, Massachusetts 02181 (617-237-0295). Tree collection begun 1852 by H. H. Hunnewell. A private estate, but visiting by the horticultural public is permitted. All areas open, except around house.

Hours Daylight, daily (greenhouse 9 A.M.-5 P.M.). **Area** 40 acres. Staff of 6. One of the most noteworthy conifer collections in the U.S. Many 19th century trees still live. Among the outstanding specimens are false-cypress (*Chamaecyparis obtusa*; *C. pisifera*) in variety; white fir (*Abies concolor*); dwarf Alberta spruce (*Picea glauca* 'Conica') and Sargent weeping hemlock. Numerous rare conifers. Hatfield yew (*Taxus media* 'Hatfieldii') originated here. Few trees currently labeled.

Sizable rhododendron collection with peak display at end of May. Greenhouse



View of plant family beds, Botanical Garden of Smith College, Northampton.

orchid display in March. The remarkable Italian topiary garden, located next to Lake Waban, is of year-round interest. Across the lake is Wellesley College, which has a small botanic garden.

Directions Pinetum is 15 miles southwest of Boston on Rte. 16, 1 mile south of Wellesley.

Weston. Case Estates of the Arnold Arboretum, 135 Wellesley St., Weston, Massachusetts 02193 (617-894-0208). Established 1942.

Hours 9 A.M.-6 P.M., mid-April to September. **Area** 11 acres. Staff of 3. Permanent tree and shrub nursery (cultivars). Points of special interest: small street trees; ground cover plots; low maintenance garden. Daffodil, day-lily (*Heemerocallis*) and lily collections. Peak display: May.

Directions Weston is 13 miles west of downtown Boston. From intersection of Rtes. 128 and 20, follow Rte. 20 west 1 mile to Wellesley St. Turn left on it.

See also Jamaica Plain, Mass. Arnold Arboretum.

NEW YORK

Albertson. Fanny Dwight Clark Memorial Garden of the Brooklyn Botanic Garden, 193 I.U. Willets Rd., Albertson (Long Island), New York 11507. Established 1966, a gift of Grenville Clark. Adult courses (see Brooklyn Botanic Garden course announcements). Parking 50 cents. Plant sales.

Hours Undetermined at press time. (Call 212-622-4433 for current information). **Area** 12 acres. Staff of 2 (3). A garden-in-the-making, with three lakes constructed and several hundred trees and shrubs planted in an open woodland setting.

Directions Long Island Expressway or Northern State Parkway to Willis Ave. exit. South on Willis Ave., then east (left) on I.U. Willets Rd. Garden is next to Albertson railroad station (Long Island Railroad). Allow one hour by car from New York City.

Also nearby: Old Westbury Gardens (see *Old Westbury, N.Y. listing*), a 5-minute drive east of Clark Garden via I.U. Willets Rd. Willets Rd. ends a few hundred feet from the Old Westbury Gardens entrance (Old Westbury Rd.).

Clinton. The Root Glen 107 College Hill Rd., Clinton, New York 13323 (315-853-6368). Established as a private garden 1849; opened to public 1964. Privately endowed by Root Glen Foundation, with support from "Friends of the Root Glen." Brochure. Children's and adult education programs, eventually on a regular basis. Groups of 10 or more: notify before coming. Picnic area nearby.

Hours Dawn-dusk. **Area** 10 acres. Staff of 1 (4). Collections: alpine plants in raised beds; Saunders peonies. Specimen trees: black walnut; Norway maple.

Directions Root Glen is located opposite Hamilton College campus; 1 mile west of village of Clinton; 10 miles southwest of Utica.

Cross River. Meyer Arboretum Ward Pound Ridge Reservation, Cross River, New York 10518. Founded 1965. Operated by Westchester County Department of Parks, Recreation and Conservation (County Office Building, White Plains 10601 (914-763-3493)). Children's and adult education programs. Guided field trips. Natural science exhibits. Reservation map on request. Labeled nature trails. Picnic area, snack bar (closed Mondays and in winter).

Hours 9 A.M.-sunset daily. **Area** 175 acres. Staff of 1 (more in summer). Arboretum contains plants native to Westchester County in forest tract. Six-acre **Luquer-Marble Memorial Wildflower Garden** has over 100 kinds of wildflowers.

Directions Reservation entrance is on Rte. 121, south of junction with Rte. 35. From Taconic or Saw Mill River parkways or Rte. 864, take Rte. 35 east, then south on Rte. 121. Parking fee: June-August, weekdays 50 cents; May-September, weekend & holidays \$1. Arboretum

but one part of the Reservation, is 1½-hour drive from New York City.

Also nearby: Hammond Museum in North Salem (which see).

Esperance. George Landis Arboretum Esperance, New York 12066 (518-875-6935). Established 1951. Incorporated under Regents of State of New York. Limited support from membership. Brochure. Adult courses, usually Saturday mornings, May-October. Field trips. Picnic area on premises.

Hours Continuously, April 1-November 15. **Area** 100 acres. **Kinds of plants** 2,500. Staff of 4. Special collections: conifer; southern Appalachian plants; bonsai; spring bulb. Rose and iris gardens. Of particular interest: 300-500-year-old white oak (*Quercus alba*); fine young specimen of bristlecone pine (*Pinus aristata*). Nature trails. Peak display April 15-May 30.

Directions Esperance is on Rte. 20, 30 miles west of Albany. Arboretum is 2 miles north of village. Follow signs from center. Nearest lodgings on Rte. 20 between Esperance and Sloansville.

Also nearby: Jackson Garden Union College campus, Schenectady (17 miles east of Esperance).

Garrison-on-Hudson. Boscobel Restoration Rte. 9D, Garrison-on-Hudson, New York 10524. Founded 1961 to relocate States Morris Dyckman mansion (ca. 1800). Admission, including house tour and "Sound and Light" program (Wednesday and Saturday evenings, 9 P.M., June-Labor Day): adults \$2.75; under 21, \$1.25. Last house tour 6 P.M. Reservations required for "Sound and Light"; call (914) 265-3638; from New York City, 562-7444. For further information, see brochure. Gift-book shop.

Garden hours 9:30 A.M.-5 P.M., April-October (4 P.M. in winter). Closed Tuesdays; also Thanksgiving, Christmas; January-February. **Area** 36 acres. Staff of 17. Areas of special interest: *orangerie*, English, herb and boxwood gardens. Rose



Branch structure of contorted beech, George Landis Arboretum, Esperance.

and orchid collections. Nature trail (summer 1971). Peak display: spring, early summer. Garden partly labeled.

Directions Best route from New York City: George Washington Bridge westbound to Palisades Parkway (north), east on Bear Mountain Bridge, north on Rte. 9D. About 1½ hours by car from mid-Manhattan. Boscobel is 7 miles north of Peekskill.

Holley. Fancher Arboretum Fancher Campus, State University College at Brockport, Lynch Rd., Holley, New York 14470 (716-638-6922). Established 1967. University-operated. Guided tours on Arboretum Day, 1st Sunday in October. Mimeographed guidebook available on trails. *Arboretum Newsletter* sent on request. Picnic area nearby on campus.

Hours Sunrise-sunset. **Area** 50 acres. Staff of 2. A woodland arboretum that is mainly a reconstruction of natural forest communities of New York State plants. Specimen trees: shagbark hickory (*Carya ovata*); hop-hornbeam (*Ostrya virginiana*). Autumn color: mid-October.

Directions Arboretum 30 miles west of Rochester via Rte. 31. Five miles west of Holley on Rte. 31, turn left on Lynch Rd.

Hyde Park. Vanderbilt Mansion Rte. 9, Hyde Park, New York 12538, 914-229-9115). Mansion built by Frederick W. Vanderbilt in 1898; arboretum initiated by Dr. David Hosack in 1828. Operated by National Park Service. Brochure. *Vanderbilt Mansion* (Historical Handbook No. 32) available for 40 cents from Superintendent of Documents, Washington, D. C. 20402. Admission to grounds free, Mansion 50 cents (also valid for **Franklin D. Roosevelt Home**, 2 miles south). Sales desk. Picnic area.

Hours Grounds, year-round, 9 A.M.-dusk; mansion, 9 A.M.-5 P.M. daily, June 15-Labor Day (closed Monday rest of year). **Area** 211 acres. In his latter years, Dr. Hosack (1769-1835), founder of New York City's Elgin Botanic Garden (now the site of Rockefeller Center), hired Belgian landscape gardener André Parmentier to design his Hyde Park estate. Some of the trees, including an immense ginkgo planted about 1830, still thrive. Old sugar maples, white pines, Kentucky coffee-trees, many others. Italian garden, vistas. Site overlooks Hudson River. Trees sparsely labeled.

Directions Vanderbilt Mansion is 6 miles north of Poughkeepsie on Rte. 9.

Ithaca. The Cornell Plantations 100 Judd Falls Rd., Ithaca, New York 14850 (607-256-3020). Founded 1935 ("Cornell Arboretum" until 1944). University-operated, with limited financial support from membership. Guided tours for groups. Brochure. Quarterly publication: *The Cornell Plantations*. Periodic educational exhibits. Traveling photographic display. Restaurant on campus.

Hours Dawn-dusk. **Area** 1,500 acres. Staff of 10. Areas of special interest: Mary Rockwell Azalea Garden; Wild-flower Garden (marked nature trails); hedge displays; synoptic shrub garden.

Plant collections: viburnum; lilac; tree peony; rhododendron; nut trees. Peak displays: spring flowers; autumn color. A master landscape plan for this essentially woodland-field arboretum has recently been drawn and will be implement-

ed in the 1970's.

Directions Cornell University is in the Finger Lakes region, at the south end of Cayuga Lake. The major part of Cornell Plantations lies in the valleys of Cascadilla and Falls Creeks, east of the campus. Ithaca buses go to center of campus. Then walk east on Tower Rd. to Plantations.

Also at Cornell: W. C. Muenscher Poisonous Plants Garden on the grounds of the Veterinary College.

Locust Valley. Bailey Arboretum Bayville Rd., Locust Valley (Long Island), New York 11560. The former Frank Bailey estate, opened to the public in 1969 by Nassau County Recreation and Parks Division (516-676-4497), with support from "Friends of Bailey Arboretum." Adult courses. Brochure. Parking charge: 50 cents.

Hours 10 A.M.-5 P.M., March 1-November 15. **Area** 42 acres. Staff of 5. Over 600 kinds of trees and shrubs, some dating to about 1916. Specimen trees: metasequoia; dwarf Nikko fir (*Abies homolepis* 'Prostrata'); black walnut; variegated beech (*Fagus sylvatica* 'Tricolor'); fragrant snowbell; katsura-tree. Tree peonies, boxwood, viburnums. Nature trails. Greenhouse.

Directions From Exit 39 of Long Island Expressway, take Glen Cove Rd. (Rte. 107) north to Glen Cove. From Glen Cove, east on Rte. 1 (Forest Ave.) to Rte. 16. Continue east on Rte. 16 (Buckram Rd.) to Bayville Rd. Left (north) on Bayville Rd. to Arboretum. Regional directional map available from Bailey Arboretum. Also, Long Island Railroad to Locust Valley from New York.

Also nearby: Planting Fields Arboretum in Oyster Bay (which see), a 15-minute drive from Bailey Arboretum via Buckram and Planting Fields Rds.

Nassau County Recreation and Parks Division (address: Eisenhower Park, East Meadow, N.Y. 11554 (516-292-4200)) also plans to eventually open to the public **Christie Pinetum** in Syosset and **William Cullen Bryant Preserve** (formerly Friel Estate—Clayton Pinetum) in Roslyn.



Above: Christie Pinetum in Syosset, New York. Right: Road leading to the Great Bowl, The Cornell Plantations at Ithaca, New York.



Millbrook. Innisfree Garden Tyrrell Rd., Millbrook, New York 12545 (914-677-8000). Open to the public since 1960 (former estate of Walter Beek; garden begun about 1930). Operated by privately endowed Innisfree Foundation, Inc. Brochure. Admission: no charge weekdays; adults \$1.50, weekends.

Hours Tuesday-Friday 10 A.M.-4 P.M., weekends 11 A.M.-5 P.M. Closed Monday. **Area** 1,000 acres, mostly woodland and lake, with landscaped terraces surrounding the mansion. An "architect's garden," constructed with one man's view of Oriental balance and aesthetics. Imaginative stonework; views from mansion. Plants not labeled. Extensive nature trails.

Directions Best route from New York City: Taconic Parkway north to Rte. 44, then east 13½ miles to Innisfree signs (Tyrrell Rd.).

A 25-minute drive southwest of Millbrook on Rte. 44 leads to **Vassar College** in Poughkeepsie (turn left on Raymond Ave. from Rte. 44). Campus has many fine old trees (unlabeled).

Also see Hyde Park: Vanderbilt Mansion.

Newark. National Rosegarden Division of Lilac Time, Inc., 1111 S. Main St. (Rte. 88), Newark, New York 14513 (315-331-7597). Formerly Jackson & Perkins Rose Garden (begun 1946), purchased in 1970 by Lilac Time, perfume manufacturers. Admission free, parking 50 cents at peak season. A complex of buildings, including arena theatre and organ museum, is currently being added to Rosegarden. "History of Rose" museum in progress. Brochures. Gift shop, children's play garden. Picnic facilities, café.

Hours Open continuously mid-June to October 1. **Area** 15 acres. Staff of 25. About 175 rose varieties (36,000 bushes). Herbaceous perennials; old lilacs. Plants labeled. Specimen trees: pin oaks, lindens, crab-apples, others.

Directions Rosegarden is 30 miles east of Rochester via New York Thruway. Take Exit 42 or 43 to Phelps, then north 5 miles on Rte. 88 to Rosegarden.

Also nearby. One mile south of Rosegarden on Rte. 88: **Sarah Coventry, Inc.**, which has a 187-acre park. Formal gardens; bird sanctuary. Display fountains lighted at night. Open to 10:30 P.M.

New Paltz. Mohonk Gardens Mohonk Lake, New Paltz, New York 12561 (914-255-1000). Garden established in 1890's on grounds of resort, Mohonk Mountain House. Admission: \$1.50 per person plus \$2.00 per car. Garden free to hotel guests. Garden, nature tours and lectures for groups by appointment. Gift shop. Garden guide 15 cents. Numerous nature publications. Restaurant, picnic lodge.

Hours Always open. **Area** 15-acre garden in 7,500-acre preserve. Seasonal staff of 10. Rose garden (old-fashioned roses), extensive annual and perennial borders. Rock garden and planted wall. Crab-apples. Marked fern-wildflower trail.

Unusual specimen trees: umbrella-pine; yellow-wood. Also, cut-leaf Japanese maple; tree lilacs; cut-leaf, weeping and copper beeches. Greenhouse. Guide maps help identify garden plants. Peak display in summer.

Directions Transportation facilities include small airport with charter service, 11-passenger limousine to New York City by arrangement. Adirondack Trailways bus to New Paltz. Given notice, Mohonk car will meet bus. By car, Exit 18 on New York Thruway, then Rte. 299 west, following Mohonk signs, 6 miles. Resort is in the Catskills, 60 miles northeast of New York City.

New York City (Bronx). New York Botanical Garden Bronx Park, Bronx New York 10458 (212-933-9400). Founded 1891. Private corporation, one-half of the operating funds deriving from the City of New York, the other half from endowment, gifts, membership. Adult (certificate) courses, also short courses. Gardener-training program for high school students. Courses for N.Y.C. teachers. Children's program. Public lecture series. Brochure \$1. Course folder.

Publications: *Garden Journal*; *Eco*

nomie Botany; various bulletins; botanical periodicals and books, including *Wild Flowers of North America*. Extensive museum-type displays. Gift and book shop. Parking \$1. Picnic area, snack bar (Lorillard Snuff Mill). Tractor-train tours.

Hours 10 A.M.—dusk. **Area** 239 acres. Staff of 225, including large research department. **Kinds of plants** 15,000. Most of the formal plantings, including rock and herb gardens and flower borders, as well as native plant garden, are located toward the north end, near the conservatories and Museum Building. Rose garden, Montgomery Dwarf Conifer Collection. Peak displays May-June (flowering trees and shrubs); September-October (chrysanthemums, dahlias).

Extensive conservatory greenhouses (10 A.M.—4:30 P.M.). Economic plants; rain forest; ferns; orchids; cycads; cacti and other succulents. Seasonal conservatory displays.

Part of the arboretum is a mature woodland with tall tulip-trees and hemlocks, significant as one of the last undisturbed forests in the greater metropolitan area. In cultivated parts of the Garden, the following specimen trees are noteworthy: *Franklinia*; Chinese fringe-tree (*Chionanthus retusus*); paperbark maple (*Acer griseum*); Tanyosho pine (*Pinus densiflora* 'Umbraculifera'); various conifers.

Directions New York Botanical Garden, immediately north of the **Bronx Zoo** and adjacent to **Fordham University**, is at the south end of Moshulu Parkway, near the Allerton exit of Bronx River Parkway. Fastest transit from mid-Manhattan is Penn Central Railroad (Harlem Branch) to Botanical Garden Station. Subway: IND "D" train to Bedford Park Station (walk 6 blocks east to Garden); also by 3rd Ave. elevated north from 149th St. Station to 200th St.

New York City (Bronx). **Wave Hill Center for Environmental Studies** 675 W. 252nd St., Bronx, New York 10471 (212-549-2055). Founded 1965. Operated by Cultural Affairs Administration of



Natural stone sculpture at Innisfree Garden, Millbrook, New York.

N.Y.C. Parks Department. Children's and adult education programs. Special programs for elementary school teachers. Family walking tours and films on Sunday afternoons except in summer. Picnic area nearby in Van Cortland Park at Moshulu entrance. Plant sale.

Hours 10 A.M.—4 P.M., Thursday-Sunday, mid-April—mid-November. **Area** 28 acres. Staff of 25. Collections partly labeled. Wildflower, rose and herb gardens. Aquatic plantings. Nature trail. Peak displays: April—mid-June; September-October.

Directions Wave Hill, which is in the northwestern tip of New York City, may be reached by car from mid-Manhattan via West Side Highway Henry Hudson Parkway. Take 250th St. exit, proceed north to 252nd, then left (west) over parkway bridge to entrance. Subway: IRT 7th Ave. Broadway-Van Cortland train to 231st St., then City Line bus from northwest corner of 231st St. & Broadway to 252nd St. Cross parkway bridge and follow 252nd St. to gate.

Also nearby: **New York Botanical Garden (Bronx)** A 15-minute drive from Wave Hill via Henry Hudson and Moshulu Parkways. (See separate entry.)



Photographs by Gottscho-Schleisner

View within the herb garden at the Brooklyn Botanic Garden, Brooklyn, New York.

New York City (Brooklyn). Brooklyn Botanic Garden, 1000 Washington Ave., Brooklyn, New York 11225 (212-622-4433). Founded 1910. Private corporation, with one-half of the operating funds deriving from the City of New York, the other half from private sources (endowment, gifts, membership). Membership organization. Plant sale.

Extensive adult and children's instruction programs, based on the "learn-by-doing" principle and conducted partly in special greenhouses. The children's vegetable gardens form an integral part of the educational pattern.

Lecture tours and classes for city school groups. Courses for teachers. Seed distribution program to New York City schools. Adult short-course folder includes classes at outreach stations (see below).

Quarterly publication: **PLANTS & GARDENS**, also issued in Handbook form. (See back cover of this Handbook for current list.) Occasional scientific bulletins. Brochures for Garden and outreach stations. Guided tours for groups by arrangement.

Hours 8 A.M.-dusk Monday-Friday, May 1-September 1; 10 A.M.-7 P.M. weekends and holidays. Rest of year: 8 A.M.-

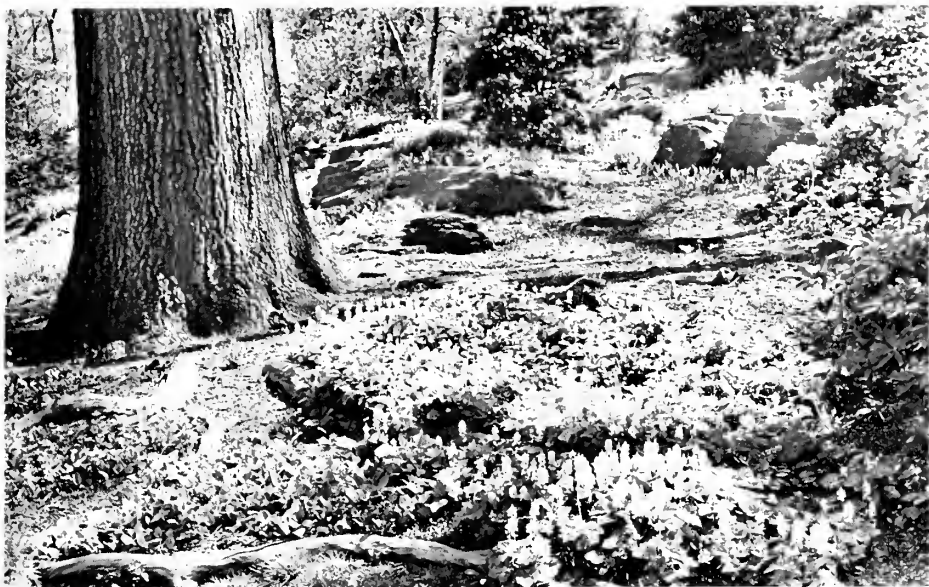
4:30 P.M. weekdays; 10 A.M.-4 P.M. weekends and holidays in winter. Staff of 82 (90). **Area** 50 acres. **Kinds of plants** 12,000. Special gardens within the larger framework: Japanese hill-and-pond; herb; rock; fragrance; iris; Ryoanji (stone); others. Cranford Rose Garden. Annual and perennial borders. Water-lily pools. Peak displays April-June; September-October.

An attractively landscaped, mature arboretum, with trees and shrubs grouped in part by their botanical relationships. Special collections: Japanese flowering cherry, crab-apple, maple, rhododendron. Numerous Kwanzan cherries, usually in flower in early May, provide the most conspicuous display in the Garden.

A few uncommon specimen trees are monarch birch (*Betula maximowicziana*); Chinese tree quince (*Cydonia sinensis*); *Davidia*; *Parrotia*; Daimyo oak (*Quercus dentata*); *Zelkova sinica*.

Greenhouses: 11 A.M.-4 P.M. Rain forest; economic plants; ferns; cycads; bromeliads; cacti and other succulents. The bonsai collection is one of the most extensive outside of Japan.

The outreach stations are **Kitchawan**



Section of Native Plant Garden at New York Botanic Garden, Bronx Park, New York.

Research Laboratory 712 Kitchawan Rd. (Rte. 134), Ossining, N.Y. 10562 (223 acres) (914-941-8886); **Teatown Lake Reservation** Spring Valley Rd., Ossining (306 acres) (914-762-2912); **Clark Memorial Garden** (see Albertson, N.Y. listing). All have nature trails and offer adult courses. Children's program at Teatown.

Directions Best car route to Botanic Garden from Manhattan: cross Manhattan Bridge and continue straight on Flatbush Ave. Bear left around Grand Army Plaza and go east one long block on Eastern Pkwy. Turn right on Washington Ave. Parking lot (50 cents) between Brooklyn Museum and Botanic Garden. Subway: 7th Ave. IRT Express downtown to Brooklyn Museum-Eastern Pkwy. station; also BMT Brighton Line to Prospect Park station.

New York City (Queens). **Queens Botanical Garden** 42-50 Main St., Flushing, New York 11355 (212-886-3800). Established 1963. Subsidized by City with additional support from membership and fund-raising activities. Adult instruction

programs. Guided tours for groups by reservation. Gift shop. Quarterly publication: *Gardens on Parade*. Picnic area in adjacent Flushing Meadow Park.

Hours 9 A.M.-dusk. **Area** 26 acres. Staff of 17. Rose and ericaceous gardens. Fragrance garden for the blind. Dwarf conifers. Tulip display late April-early May; chrysanthemums, September 15-November 15. Greenhouse.

Directions Best car route from mid-Manhattan: Midtown Tunnel to Long Island Expressway. Take Main St.-Flushing exit, go north (left) on Main, then left on Dahlia Ave. Garden entrance is 2nd gate. Subway: IRT Flushing Line from Grand Central Station to Main St., then walk south to Garden or take Q44 bus to Main St. & Elder Ave.

North Salem. **Hammond Museum** North Salem, New York 10560 (914-669-5033). Founded 1957. Non-profit corporation with support from membership. Museum has Great Hall and 6 galleries with changing art exhibits. Cultural events: concerts, films, lectures. Brochure. Garden booklet, listing plants by number, free at gate.

(Continued)



Marjorie J. Dietz, Louis H. Frohman

Above: View of box-wood garden across lake at Old Westbury Gardens, Old Westbury, New York. Right: Statuary and wisteria embellish the mansion at Lyndhurst, Tarrytown, New York.



Admission: adults \$1 to Museum, \$1 to garden; children 75 cents to Museum. Women urged to wear low-heeled shoes. Restaurant and motel list at desk. Gift shop.

Hours 11 A.M.-5 P.M. Wednesday-Sunday, May 30-October 31 (Museum open to December 24). Staff of 9. **Area** 3½-acre Oriental Stroll Gardens with 30-mile view. Zen gardens, reflecting pool, Dry Waterfall Garden, others.

Directions Hammond Museum, in northern Westchester County, is a 1¾-hour drive from New York City. From Saw Mill River Parkway, go east on Rte. 116, then north a short distance on Rte. 124 to Deveau Rd. East on Deveau Rd. to Museum. If coming from Rte. 84, take Exit 19 south.

See also Cross River. Meyer Arboretum.

Oakdale. Bayard-Cutting Arboretum Box 66, Montauk Highway, Oakdale (Long Island), New York 11769 (516-581-1002). Begun as private estate in 1886 by Mr. Cutting (landscape architect: Frederick Law Olmsted). Operated since 1954 by Long Island State Park Commission. Private endowment administered by Board of Trustees. Parking \$1; walk-in fee 25 cents. Brochure. Nature exhibits. Cafeteria. Picnic facilities in nearby Hecksher State Park.

Hours 9 A.M.-6 P.M., April 15-October 30; 9 A.M.-dusk, winter. **Area** 690 acres (about 75 landscaped). Staff of 27 (seasonal). Over 400 kinds of trees and shrubs. Some of the old conifers, of which there is an extensive collection, are magnificent specimens. Among them: Cilician fir (*Abies cilicica*); blue Atlas cedar (*Cedrus atlantica* 'Glauca'); Sargent weeping hemlock (*Tsuga canadensis* 'Pendula'); Sawara-cypress (*Chamaecyparis pisifera* forms); dwarf Norway spruce.

Other collections: rhododendron and azalea; lilac. Rose garden. Various nature-trails, including swamp-cypress walk. Bird sanctuary.

Directions The Cutting Arboretum, on the south shore of Long Island, is 1½-hour drive from New York City via

Southern State Parkway. Exit at Rte. 27A (Montauk Highway) and proceed east ½ mile to entrance. Long Island Railroad stations at Islip, Great River and Oakdale (taxi thence to Arboretum). Half-mile walk to Arboretum from Great River station. Freeport-Patchogue bus stops at Arboretum entrance every 45 minutes.

Old Westbury. Old Westbury Gardens Box 265, Old Westbury Rd., Old Westbury (Long Island), New York 11568 (516-333-0048). The former John S. Phipps estate. Gardens started 1905, opened to the public 1959. Privately endowed, with support from membership. Admission to grounds: adults \$1.50, children 6-12 50 cents. Admission to house extra. Brochure. Booklet on Westbury House (50 cents). School tours May-June. Garden club tours by appointment. Members' programs. Gift shop. Picnic area.

Hours 10 A.M.-5 P.M., Wednesday-Sunday and holidays, early May-late October. **Area** 100 acres. Staff of 25. Resembles 18th-century park with Georgian mansion; broad vistas; avenues of linden and beech trees; separate gardens (boxwood, cottage, rose and Italian gardens). Italian garden has 2 acres of flower borders. Pinetum; rhododendrons and azaleas; primroses. Wildflower garden (trails). New "answer" gardens devoted to shade-tolerant plants, low maintenance.

Many fine old specimen trees, including crack willow (*Salix fragilis*), red and silver maples; white and Korean pines; also, blue Atlas cedar (*Cedrus atlantica* 'Glauca'); cucumber magnolia (*Magnolia acuminata*). Peak display: May-July; September-October.

Directions Old Westbury is 22 miles east of New York City, about one hour by car. Take Exit 39S (Guinea Woods Rd.) off Long Island Expressway and continue east on Exp. service road 1.2 miles to Old Westbury Rd. Right turn to Gardens. Public transportation: Long Island Railroad to Westbury, then taxi.

See also Albertson. Clark Memorial Garden of Brooklyn Botanic Garden.

Oyster Bay. Planting Fields Arboretum Box 58, Planting Fields Rd., Oyster Bay (Long Island), New York 11771 (516-922-6000). Former William Robertson Coe estate, operated since 1955 by State University of New York. Parking \$1. Adult instruction program. Educational exhibits in Arboretum Center. Tour groups by appointment. Brochure, "How to Know and Grow Holly," bulletin, 10 cents.

Hours 10 A.M.-4 P.M. daily. **Area** 409 acres. Staff of 60 (75). **Kinds of plants** 5,500. Although Mr. Coe began his arboretum in 1916, it seems older today because of his practice of planting mature trees. Some of them, enhanced by broad lawns and vistas, are now magnificent specimens. Outstanding trees: silver linden (*Tilia tomentosa*); cedars (*Cedrus*); golden English elm (*Ulmus procera* 'Aurea'); European beech and its forms. The Sargent weeping hemlock is one of the finest anywhere.

The Synoptic Garden at Planting Fields is an attractive "teaching garden" with choice shrubs arranged alphabetically. Among the choicest are Japanese eleuthra (*Clethra barbinervis*) and southern leatherwood (*Cyrilla racemiflora*). Also of interest: extensive rhododendron and azalea collection; hollies; dwarf conifer garden.

Display greenhouses (10 A.M.-4 P.M., Monday-Friday; 1 P.M.-4 P.M., Sunday) include camellias, orchids, begonias, cacti and other succulents. Nature trails. Peak garden display April to early June.

Arboretum is 1-hour drive from New York City. From Long Island Expressway Exit 41N, take Rte. 106 north to Rte. 25A, then west (left) ½-mile to Mill River Rd. (right), where Arboretum directional signs begin.

Bailey Arboretum (Locust Valley) is a 10-minute ride northwest. Continue west on Planting Fields Rd. to Chicken Valley Rd.-Buckram Rd. Right (north) on Buckram (Rte. 16) to Bayville Rd. Right on Bayville Rd. to Bailey Arboretum.

Also nearby: **Gardens at State University Agricultural and Technical College**, Rte. 110, Farmingdale. From N.Y.C. go east on Northern State Pkwy. to Exit

40, then south on Rte. 110 to campus. Flower borders, rose garden. Trials for annuals and other herbaceous plants. Farmingdale is about a one-hour drive from N.Y.C. and a 35-minute drive from Planting Fields Arboretum.

Rochester. Durand-Eastman Park Kings Highway, Rochester, New York. (Administrative address same as for Highland Park—see below). Founded 1908. Picnic area.

Hours Dawn-11 P.M. daily. **Area** 500 acres. This and Highland Park have about 4,000 kinds of plants. The emphasis at Durand-Eastman Park is on flowering trees: crab-apples, Japanese cherries and magnolias. The conifer collection is also noteworthy. Old specimens of fragrant snowbell (*Styrax obassia*). Peak display is late April-May.

Directions Durand-Eastman Park, next to Lake Ontario, is 7 miles north of Rochester via Kings Highway. No. 10 Portland-Seabreeze bus northbound from center.

Rochester. Highland Park Mt. Hope Ave. and S. Goodman St. at Reservoir and Highland Aves., Rochester, New York. This and the preceding are parts of the Monroe County Parks system (administrative address: 375 Westfall Rd., Rochester, N.Y. 14620, 716-244-4640), which distributes folder and map. Founded 1888. Information booth. Picnic area. Restaurants nearby.

Hours dawn-11 P.M. daily. **Area** 125 acres. Staff of 30 (including Durand-Eastman Park). A mature arboretum with many rare trees and shrubs. The 550 named lilac varieties, usually in peak flower the third week of May, form one of the largest such collections in the U.S. A few of the fine old trees are single-leaf ash (*Fraxinus angustifolia monophylla*); Turkish hazelnut (*Corylus colurna*); oaks; hawthorns; Asiatic maples; and forms of European hornbeam (*Carpinus betulus*). The Park was a trial ground for turn-of-the-century introductions from China.



Gottsch-Schleisner

Path of azaleas leads to Coe Hall at Planting Fields Arboretum, Oyster Bay.

Other displays: rhododendron and azalea, wisteria, herbaceous and tree peonies. Flower beds: tulips, pansies, annuals, chrysanthemums. Seasonal displays in Lamberton Conservatory (9 A.M.-5 P.M. daily). **Poets Garden** (sponsored by Rochester Garden Club), Werner Castle grounds of Garden Center (5 Castle Park, off Reservoir Ave.); **Maplewood Rose Garden**, Lake Ave. (administered by Recreation Bureau, City of Rochester).

Directions Highland Park is located immediately south of downtown Rochester. No. 5 Strong-Lola bus southbound from center.

Schenectady. Jackson Garden of Union College, Nott St., Schenectady, New York 12308 (518-346-8751). Established 1834. Part of Union College campus. Guided tours can usually be arranged.

Hours Daylight, spring-autumn. **Area** 20 acres (part cultivated). Staff of 1 (5). Rose, evergreen and wildflower gardens. Special collections: tree peony (old specimens); Japanese anemone; primula; fern. Also tuberous begonias; annuals.

Directions College is between Union & Nott Sts., with the garden on the Nott St. side of the campus.

Tarrytown. Lyndhurst 635 S. Broadway (Rte. 9), Tarrytown, New York 10591 (914-631-0046). Gothic Revival mansion built in 1838 by Gen. William Paulding. Enlarged by subsequent owners, including Jay Gould, who bought it in 1880. The architectural influence of A. J. Downing is strong. Arboretum started about 1870 by George Merritt. In 1964 Gould's daughter Anna, Duchess of Talleyrand-Perigord, gave property to National Trust for Historic Preservation (740-748 Jackson Place, N.W., Washington, D.C. 20006), a membership organization. House tours; adults \$1.50, students 75 cents. Group rates by arrangement. Brochure. *Lyndhurst*, 44-page booklet, \$1. Picnic area. Gift shop.

Hours 10 A.M.-5 P.M. daily, April 1-October 31. **Area** 67 acres. Staff of 70 (including house). Attractive horticultural park overlooking the Hudson River, with many trees planted during last century, including fine specimens of larch; linden; weeping beech; ginkgo; star magnolia. Also cut-leaf Japanese maple trees, among the largest in U.S. Trees unlabeled. There are plans to restore the remarkable 380-foot greenhouse, thought to have been at one time the longest in the country. Rose garden. Nature trails.



Daffodils on the hillside in the Winterthur Gardens near Wilmington, Delaware.

Directions Lyndhurst is a 45-minute drive from New York City via New York State Thruway. Exit at Rte. 9 and go south $\frac{1}{2}$ mile to entrance. It is near Tappan Zee Bridge. Train to Tarrytown station from Grand Central Terminal in N.Y.C.

Sunnyside. Washington Irving's home is a short drive south of Lyndhurst on Rte. 9.

Tuxedo. Sterling Forest Gardens Rte. 210 (Box 608), Tuxedo, New York 10987 (914-351-2163). Established 1960. Commercial enterprise. Admission: adults \$2.50, children \$1. Gift shop. Children's attractions. Restaurant. Picnic facilities. A section of the gardens becomes ski area in winter.

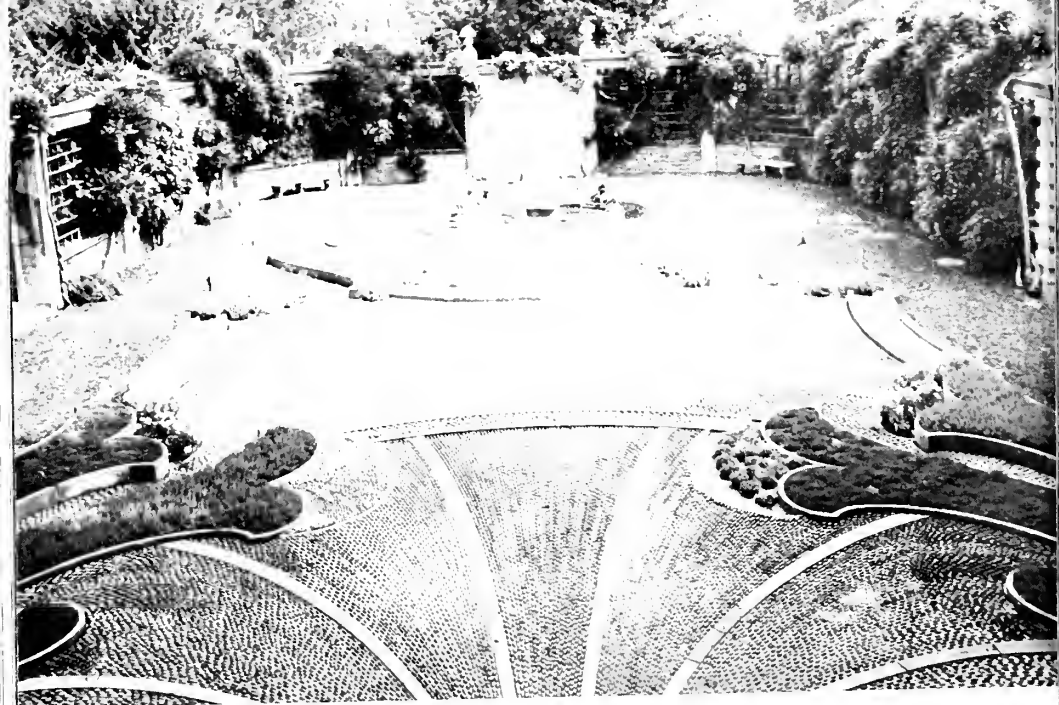
Hours 9:30 A.M.-6 P.M. daily, May

1-late October. **Area** 80 acres. Staff of 20. Display garden with emphasis on bright flower color. Flower beds changed three times each season. Plants labeled. Extensive tulip bloom, May 5-20. Tuberous begonias and summer annuals, best from mid-July to mid-August. Chrysanthemums, mid-September to mid-October. Rose garden; "Home Garden of Ideas" (sponsored by Chemical Bank); poetry garden.

Directions Sterling Forest is 45 miles north of New York City via George Washington Bridge, then west on Rte. 4 to Rte. 17 north (or via Deegan Expressway to N.Y. Thruway, Exit 15 at Suffern, then Rte. 17 north). Go north through town of Tuxedo, then left on Rte. 210 to Garden entrance. Short Lines bus (daily) from Port Authority Bus Terminal in Manhattan direct to Garden.



View of the water garden at Sterling Forest Gardens.



Stewart Bros., Inc.

Hampster



MIDDLE ATLANTIC STATES

DELAWARE

Winterthur. Winterthur Gardens Rte. 52, Winterthur, Delaware 19735 (301-656-8591). Established 1839. Operated by the privately owned Henry Francis du Pont Winterthur Museum, which has an outstanding collection of early American furniture. Estate of the late Henry du Pont.

Admission (hours, dates and fees vary for Museum areas): from \$1 for adults, 50 cents for children (Gardens), to \$2.50. Brochures. Bookstore. Books on Winterthur: *Winterthur in Bloom* (soft or hard cover), *The Gardens of Winterthur in All Seasons*. Restaurant. No picnics.

Hours 10 A.M.-4 P.M., Tuesday-Sunday, April 13-May 22; same hours and days, October 1-31 (1971 dates). Dates vary slightly year-to-year. **Area** 64 acres. Staff of 38.

A magnificent woodland garden with large groups of azaleas which complement native flowering dogwoods and tall tulip-trees. Peak azalea bloom in May. Of special interest: primula quarry; heather gardens; wildflowers; rhododendrons; viburnums; ferns.

A substantial pinetum includes a 60-foot metasequoia; large specimens of blue Atlas cedar (*Cedrus atlantica* 'Glauea'); Japanese umbrella-pine (*Sciadopitys verticillata*). An old Japanese maple (*Acer palmatum*) near the Museum is probably as large a specimen as can be seen anywhere in the U.S. Venerable Japanese flowering crab-apple (*Malus floribunda*). Many uncommon trees, including *Idesia polycarpa*. Autumn color at Winterthur, in part because of the dogwoods, is outstanding.

Directions Winterthur is 6 miles

◀
Top: The Pebble Garden at Dumbarton Oaks, Washington, D.C. **Bottom:** The Azalea Woods in Winterthur Gardens, Winterthur (near Wilmington), Delaware.

northwest of Wilmington on Rte. 52. **Longwood Gardens** Kennett Square, Pa., is a 20-minute drive north of Winterthur by Rte. 52 (then left on U.S. 1). Although both gardens represent the best in the du Pont family horticultural tradition, they differ in form and mood. To see the two of them on the same visit enhances the effect of each.

DISTRICT OF COLUMBIA

Washington. Bishop's Garden and Cathedral Close Washington National Cathedral, Mount St. Alban, Washington, D.C. 20016 (202-966-3500). Established 1916. Jurisdiction of Protestant Episcopal Cathedral Foundation, with support from All Hallows Guild.

Guided tours (write: Garden Chairman, All Hallows Guild, Herb Cottage, Washington Cathedral). Brochure. Herb catalog and cookbooks at Herb Cottage Gift Shop. Herbs and perennials sold 8:30 A.M.-4:30 P.M., Monday-Saturday. Picnic areas in nearby parks.

Hours 9 A.M.-dusk, May 15-October 15; 9 A.M.-5 P.M. rest of year. **Area** 54 acres. Staff of 14. Herb and rose gardens; woodland path; flower borders. Other gardens: Garth, Hortulus and Little Garden. Specimen trees and shrubs include cedar of Lebanon; yew; Glastonbury thorn (*Crataegus monogyna biflora*); old boxwood. Only the herb garden is labeled.

Directions Cathedral is in northwest Washington, bounded by Wisconsin Ave., Garfield St., 34th St., and Woodley Rd. By public bus, take any going on Wisconsin Ave. N.W. or Massachusetts Ave. N.W.

Washington. Dumbarton Oaks 1703 32nd St. N.W., Washington, D.C. 20007 (202-232-3101). Founded 1923. Owned by Harvard University. Privately endowed. Byzantine and pre-Columbian museums. Library by appointment only. Garden guide 50 cents. Picnic area in adjacent Montrose Park.

Hours 2 P.M.-4 P.M. (closed July-

Labor Day). **Area** 17 acres. **Staff** of 14. **Areas of interest:** herbaceous border; fountain terrace; pebble and rose gardens. Elliptical aerial hedge of hornbeam (*Carpinus caroliniana*); espaliered southern magnolia (*Magnolia grandiflora*).

Specimen trees: Japanese maple, katsura-tree (*Cercidiphyllum japonicum*); deodar cedar (*Cedrus deodara*); Yulan magnolia (*Magnolia denudata*). Best times to visit are mid-April-July 1; late October.

Directions Garden is 1 block east of Wisconsin Ave., with entrance gate on R St. From downtown Washington, take any bus marked "Friendship Heights"—Nos. 30, 32 and 34.

Washington. U.S. Botanic Garden Conservatory 1st St. S.W. & Maryland Ave., Washington, D.C. 20024 (202-224-3121) (Office: 1st St. S.W. & Canal St.). Conservatory, built in 1930's, under Federal jurisdiction. Not to be confused with the National Arboretum (which see),

which more closely performs the functions of a botanical garden. Guided tours for groups by reservation. Restaurants nearby.

Hours 9 A.M.—4 P.M. **Staff** of 56. Plants include orchids, palms and other customary greenhouse subjects. Seasonal displays. Outdoor flower border.

Directions Conservatory is located at southwest corner of Capitol grounds. By bus, No. 30 from downtown areas.

Washington. U.S. National Arboretum 28th & M Sts. N.E., Washington, D.C. 20002 (202-399-5400). Established 1927. Operated by Crops Research Division, Agricultural Research Service, U.S. Dept. of Agriculture.

Children's instruction programs, including children's vegetable garden, "Widening Horizons" program for city youth. Tours for public guided by volunteers. Tours for professionals led by staff. Brochure. Home & Garden Bulletins (USDA). Picnic area for groups by ap-



Winter scene at Beech Spring Pond of the National Arboretum, Washington, D.C.

pointment. Restaurants nearby.

Hours 8 A.M.-7 P.M., weekdays, April-October; 10 A.M.-7 P.M., weekends. Winter months: 8 A.M.-5 P.M., weekdays; 10 A.M.-5 P.M., weekends. **Area** 415 acres. Staff of 100. **Kinds of plants** 7,000.

While the Arboretum has existed since 1927, most of its development has occurred in recent years. The Gotelli dwarf conifer collection is one of the most extensive in the world and is of interest any time of year.

The late B. Y. Morrison of the Glenn Dale Station (Maryland) hybridized many azaleas over the years, and the resulting large collection of Glenn Dale hybrids at the Arboretum is a fine sight in flower in the last week of April and the first week of May (Morrison Azalea Garden). Also of interest are other azaleas and rhododendrons, flowering quinces, crab-apples and cherries. There are many camellias, attractive in April-May and October.

There is an unusually large number of cultivated varieties of plants in the Arbo-

retum. In fact, staff hybridizers have been active in the selection of new pyracanthas, crape-myrtles, magnolias, viburnums and *Hibiscus*, the best of which find their way into the nursery trade.

Attention has also been given the local flora of the Arboretum in the "Touch and See" nature trail and Fern Valley. Many native trees (*e.g.*, dogwood, black walnut, Spanish oak) serve as a background for the flowering displays.

Flower shows, botanical art exhibits (changed monthly). House plant display, October-November. Christmas greens show, December.

Directions The National Arboretum is in the city limits of Washington. From downtown, take Maryland Ave. northeast from the Capitol to M St., then turn east (right) to reach main gate. Public transportation from downtown Washington: take bus No. 42 to 13th and D Sts. N.E., then transfer to bus No. B2 ("Mt. Rainier"), riding it to Bladensburg Rd. and R St. Walk east on R St. 300 yards to entrance.



A view of the Gotelli Dwarf Conifer Collection at the National Arboretum.



A section of the Holmdel Arboretum, Holmdel Park, in New Jersey.

MARYLAND

Baltimore. Cylburn Park 4915 Green-spring Ave., Baltimore, Maryland 21209 (301-542-3109). Established 1942. Operated by City (Park Board). Support from Cylburn Wildflower Preserve and Garden Center Organization, a civic group that sponsors garden and nature programs. Tours for school groups. Nature museum. Picnic areas in nearby parks.

Hours Dawn-dusk. **Area** 176 acres. Staff of 3. There are magnolia, Japanese maple (*Acer palmatum*), boxwood collections. Also herb garden, annuals, grasses, nature trails.

Directions Cylburn Park, in northwest Baltimore, is located between Northern Parkway and Coldspring Lane, off the Jones Falls Expressway.

Also in Baltimore: Conservatory and display greenhouses in **Druid Hill Park**, Gwynns Falls Parkway & Auchentrotty Terrace. Hours: 11 A.M.-4 P.M.

Wheaton. Brookside Botanical Garden 1500 Glenallen Ave., Wheaton, Maryland 20902. Established 1969. Operated by Department of Parks, Maryland-National Capitol Park and Planning Commission (301-589-1480). Brochure. Publication: *Garden Notes from Brookside* (bi-monthly). Guided tours for groups. Occasional plant sales. Picnic area in adjacent Brookside Nature Center (trails).

Hours 9 A.M.-5 P.M. Tuesday-Saturday; 1 P.M.-6 P.M. Sunday. **Area** 25 acres. **Kinds of plants** 700. Staff of 10. A garden-in-the-making. Azaleas and rhododendrons (late April-May); ornamental grasses, formal garden. Also annuals, chrysanthemums. Conservatory: changing floral displays, winter-flowering plants. Fern and gesneriad greenhouse.

Directions Garden is 10 miles north of Washington, D.C. via Rte. 97 (Georgia Ave.), then right turn on Rte. 183 (Randolph Rd.). Right turn again on to Glenallen Ave.

NEW JERSEY

Gladstone. Willowwood Arboretum Hacklebarney Rd., Gladstone, New Jersey 07934. Initiated 1908, established as an arboretum under private auspices in 1958. Operated since 1967 by Rutgers University with some private support. Primarily a facility for educational and research use of the university, but open to the public on limited scale, with guided tours for groups or interested parties by arrangement (write Dr. Benjamin Blackburn, c/o Arboretum). Field botany classes in spring or autumn (nominal charge). Picnic area at Hacklebarney State Park, 3 miles north. Restaurants nearby.

Area 130 acres. **Staff** of 6. About 2,000 kinds of trees and shrubs. Cottage herb garden; small formal garden; spring wildflowers. Japanese-style pool garden. **Principal collections:** ferns; conifer (especially pines); willows; maples; hollies; lilaes; dogwoods. Specimen trees of Atlas cedar; tulip-tree; bald-cypress (*Taxodium*); *Magnolia kobus borealis*; others. The 60-foot metasequoia is one of the tallest in the U.S. Nature trails.

Arboretum is 2 miles west of Gladstone. From Rte. 206 north, turn left (west) on Pottersville Rd. Turn right from Pottersville Rd. onto Lisk Hill or Union Grove Rds., then left on Hacklebarney Rd. Gladstone is 42 miles west of New York City via Rtes. 78, 206. Allow 1½ hours by car from mid-Manhattan.

Also nearby: **Frelinghuysen Arboretum** in Morristown (15 miles northeast via Rtes. 206, 202); **Duke Gardens** in Somerville (12 miles south via Rte. 206); **Rutgers Display Gardens** in New Brunswick (25 miles southeast via Rtes. 206, 287, 18). See respective listings.

Holmdel. Holmdel Arboretum Longstreet Rd., Holmdel, New Jersey 07733 (201-946-8819). Established 1963. Operated by Monmouth County Shade Tree Commission in conjunction with County Parks System. Field trips. Guided tours for groups by appointment. Picnic and

refreshment area.

Hours 8 A.M.-dusk. Arboretum consists of 22 acres at the south end of Holmdel Park (240 acres). There are 260 kinds of trees and shrubs contributed by local nurserymen. Collections include crab-apples; flowering cherries and other *Prunus*; magnolias; cedars (*Cedrus*); other conifers. Shrubs selected for fragrance. Dwarf conifers. Ground covers, spring bulbs. Nature trail. Peak flowering display from late April-mid-May.

Directions Arboretum is 2 miles north of Holmdel, east of Rte. 4 (Main St.) on Longstreet Rd. From Garden State Parkway Exit 114, take Red Hill Rd. south to Corner Rd. Turn right on Corner Rd., then left on Longstreet Rd. Continue to entrance at far (south) end of Park. Holmdel is 40 miles south of New York City (mid-Manhattan). Allow 1¼ hours by car.

Also nearby: **Rutgers Display Gardens** in New Brunswick (20 miles northwest via Rtes. 520, 18). See *New Brunswick listing*.

Morristown. Frelinghuysen Arboretum Box 1295R, Whippany Rd. (Rte. 5111), Morristown, New Jersey 07960 (201-285-6166). Dedicated 1971. Operated by Morris County Parks System. Former estate of Matilda Frelinghuysen, with many trees and shrubs dating from the 19th century. Brochure. Picnic area nearby.

Hours 9 A.M.-5 P.M., Monday-Friday. **Area** 125 acres. **Staff** of 7. The Parks System, which has its headquarters here, plans to add a number of trees and shrubs in the 1970's to complement the old Atlas cedar, maples, oaks and boxwood. Spring bulbs, rhododendrons and azaleas have already been added. Nature trails, wildflowers.

Directions Arboretum, located on the banks of the Whippany River, is 1 mile northeast of Morristown center (DeCamp bus #77) on the Morristown-Whippany Rd. Morristown is 30 miles west of New York City. Allow 1 hour by car from mid-Manhattan.

Also nearby: **Duke Gardens** in Somerville.

ville, N.J. (20 miles south via Rte. 287); **Willowwood Arboretum** in Gladstone (15 miles southwest via Rtes. 202, 206); **Rutgers Display Gardens** in New Brunswick (32 miles south via Rtes. 287, 18). *See respective listings.*

New Brunswick. Rutgers Display Gardens Rte. 1 & Ryder Lane, New Brunswick, New Jersey 08903 (201-247-1766). Started 1929. Operated by Dept. of Horticulture and Forestry, Rutgers—The State University. Brochure. Various bulletins, free to New Jersey residents through county agents. Picnic area along Raritan River. Restaurants nearby.

Hours 8:30 A.M.—dusk, May–September; to 4:30 P.M. rest of year. **Area** 25 acres. Staff of 6. Collections of American and Japanese hollies; small trees; rhododendrons and azaleas; annuals; hedge and vine plots; evergreens; shade trees.

The 41-acre **Helyar Woods**, north of the Display Gardens, has nature trail with sweet-gum stand (*Liquidambar styraciflua*), swamp, old oak forest, other areas of ecological interest.

Directions From Exit 9 of New Jersey Turnpike, follow signs for US 1 south (toward Trenton). Gardens are at Rte. 1 and Ryders Lane (entrance on Ryders Lane). Rutgers is 35 miles southwest of New York City. Allow 1 hour by car from mid-Manhattan.

Also nearby: **Duke Gardens** in Somerville (12 miles northwest via Rtes. 18, 206 south); **Holmdel Arboretum** in Holmdel (20 miles southeast via Rtes. 18, 520); **Frelinghuysen Arboretum** in Morristown (32 miles north via Rtes. 18, 207). *See respective listings.*

Somerville. Duke Gardens Foundation Rte. 206 South, Somerville, New Jersey 08876 (201-722-3700). Established 1959. The privately owned Doris Duke estate. Admission: \$1.75; groups of 10 or more, \$1.50 each. Guided tours only. Group and individual visits by reservation (form on request). Brochure. Picnic area in Duke Island Park, 3 miles away on Old York

Rd., Raritan (off Rte. 206).

Hours 1 P.M.–5 P.M. Closed June 30–September. **Area** 8½ acres. Staff of 60. Series of display greenhouses. Special gardens under glass: Colonial, Edwardian, Italian, French, English, Chinese, Japanese, Indo-Persian, others. Orchids, tropical plants, tree ferns, camellias, gardenias, jacaranda, cacti and other succulents. Various seasonal displays of chrysanthemums, poinsettias, bulbs, and others. Plants not labeled. Peak displays in October, December, January, April.

Directions Duke Gardens is 1½ miles south of Somerville on Rte. 206. Somerville is 40 miles west of New York City. Allow 1¼ hours by car from mid-Manhattan.

Also nearby: **Rutgers Display Gardens** in New Brunswick; **Frelinghuysen Arboretum** in Morristown; **Willowwood Arboretum** in Gladstone. *See respective listings.*

Also in New Jersey: **Herb Garden** in Waterloo Village (restoration), Netcong; **Marquand Park** and **Princeton University** campus, Princeton.

PENNSYLVANIA

Berwick. Elan Memorial Park 203 E. Front St., Berwick, Pennsylvania 18603 (717-784-5929). (Arboretum and nursery on Old Rte. 11-South, Lima Ridge, Pa.). Established 1950. Cemetery corporation, privately owned. Picnic area nearby.

Hours Dawn–dusk. **Cemetery:** 35 acres; **arboretum:** 55 acres. **Kinds of plants** 2,000. Collections of lilacs, evergreens, flowering trees. Fifty flower beds in Memorial Park include over 75 different annuals. Display greenhouse (camellias, cacti, hoyas, tender vines, and others).

Directions Memorial Park is in Berwick. Arboretum and nursery are on Old Rte. 11-South, near Lime Ridge, between Berwick and Bloomsburg, in Columbia County.

Hershey. Hershey Rose Gardens and Arboretum Hershey, Pennsylvania 17033 (717-533-9101). Founded 1936. Privately



Gottseho-Schleisner

The French Garden, one of several special, complete gardens under glass, which can be enjoyed at the Duke Gardens Foundation (Doris Duke Estate), Somerville.

endowed. Brochure. Picnic area nearby.

Hours 8 A.M.—dusk, April 10–December 1. **Area** 23 acres. Staff of 5. A display garden with 1,200 rose varieties. Peak color: April 25–May 15, tulips; June, roses; summer, annuals; September 15–October 31, chrysanthemums (200 varieties). Hollies, dwarf evergreens, day-lilies. Specimen trees: cut-leaf Japanese maples; blue Atlas cedars; other conifers.

Directions Hershey is 12 miles east of Harrisburg and is near exits of Pennsylvania Turnpike and Rte. 78. Directional signs in town for Gardens.

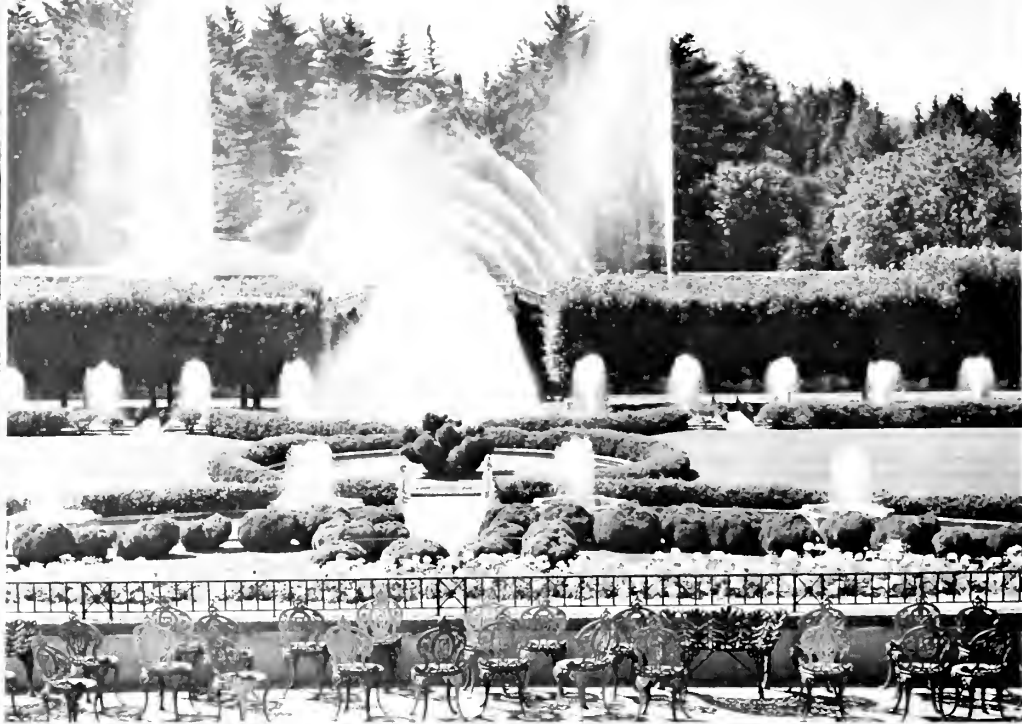
Kennett Square. Longwood Gardens
Kennett Square, Pennsylvania 19348
(215-388-6741). Arboretum established ca. 1800 by Joshua and George Peirce. Former estate of Pierre Samuel du Pont, operated by privately endowed Longwood Foundation. Three brochures on request, others from 50 cents to \$5.50

(book). Guided tours for groups of 20 or more by appointment.

Short-course lecture series; also training programs for gardeners, college undergraduates (summer), foreign students. Graduate program in horticulture with University of Delaware. Concerts, ballet, other cultural events in open air theater. Information center (postcards, film, publications). Picnic area adjacent to Gardens. Restaurants within 5 miles.

Hours 8 A.M.—dusk, grounds; 11 A.M.—5 P.M. (and some evenings), conservatories. **Area** 1,200 acres (285 open). Staff of 207. **Kinds of plants** 12,000. One of America's great gardens, with greenhouse displays as fine as can be seen—anywhere. A showplace even for those marginally interested in plants.

The extensive conservatories, including 16 display houses, are of year-round interest. January–Easter: spring bulbs, acacias, camellias; special Easter display. Spring–summer: bedding plants; Novem-



Longwood Gardens

View from patio in front of the main conservatory across Fountain Garden at Longwood Gardens, Kennett Square. The Arboretum can be seen in background.

ber 10-December 10: chrysanthemums; December-early January: poinsettias; all year: orchids. Also indoors: mild-climate rhododendrons and azaleas; bromeliads; ferns; palms and cycads; roses; insectivorous plants. Tropical houses, *orangerie*.

The well-landscaped grounds, with emphasis on fountains and vistas, include Italian, topiary, rock, herb, vegetable and wildflower gardens. Also water-lilies; annual borders; spring bulbs; chrysanthemums; dahlias.

The arboretum, one of America's oldest, has many aged, magnificent trees. Among them: ginkgo; cucumber magnolia (*Magnolia acuminata*); yellow cucumber magnolia (*M. cordata*); tulip-tree; scholar-tree (*Sophora japonica*); larch; Kentucky coffee-tree; bald-cypress (*Taxodium distichum*) in avenue. While of a later date, the avenue of empress-tree (*Paulownia tomentosa*) is often outstanding in flower in May. A pinetum includes giant-sequoia as well as a handsome group of California incense-cedars (*Calocedrus* or *Libocedrus decurrens*). Dwarf conifer garden. There

are many nature trails.

There are numerous flowering trees and shrubs, particularly dogwoods, Japanese cherries, crab-apples, azaleas and rhododendrons. Peak arboretum display occurs in late April and May, but the many kinds of bedding plants are attractive through the mild months of the year.

Directions Kennett Square is 12 miles northwest of Wilmington, Delaware via Rte. 52 and US 1 (south) ($\frac{1}{2}$ hour drive); 30 miles southwest of Philadelphia via US 1 ($1\frac{1}{4}$ -hour drive). Longwood entrance is on US 1, near the Rte. 52 (north) intersection. Accommodations on US 1, Rte. 202 or in Wilmington. **Trailway Bus** (Philadelphia-Baltimore local). Best car route from New Jersey and points north: New Jersey Turnpike, crossing Delaware Bridge, then north through Wilmington on Rtes. 95, 52. Allow $2\frac{1}{2}$ hours by car from New York City.

Also nearby: Winterthur Gardens 8 miles southeast; Tyler Arboretum in Lima, Pa. (17 miles north via US 1). See respective listings.



Side aisle of main conservatory during chrysanthemum-time display, Longwood.



Trunk and branches of Cedar of Lebanon (*Cedrus libani*), planted around 1860, at John J. Tyler Arboretum, Lima.

Lima. John J. Tyler Arboretum Box 216, 515 Painter Rd., Lima, Pennsylvania 19060 (215-566-5431). Founded ca. 1830 as the Painter Arboretum. Privately endowed corporation with support from membership. Brochure. Quarterly bulletin to members. Displays in Painter Library-Museum (1863); Lachford Hall (1738) (early American furniture). Guided nature walks in spring and autumn. Picnic area for horticultural groups by reservation.

Hours Dawn-dusk. **Area** 700 acres (part developed). **Staff** of 10. **Kinds of plants** about 4,000. Some trees planted last century by the Painter brothers still survive. Giant-sequoia, ginkgo, cedar of Lebanon, Parry pinyon pine (*Pinus cem-broides parryana*) and a few others are notable for size or rarity in the Philadelphia area.

More recent plantings: extensive rhododendron collection; dogwoods; dwarf conifers. Fragrant garden for the blind. Peak display: April-May.

Directions Lima is 15 miles southwest of downtown Philadelphia. From Philadelphia, take US 1 south to Rte. 352. North $1\frac{1}{2}$ miles on Rte. 352, then right onto Forge Rd. Go $\frac{1}{4}$ mile, then turn right on Painter Rd. Arboretum is on left.

Also nearby: **Arthur Hoyt Scott Memorial Foundation** in Swarthmore (5 miles east via Rtes. 1 north, Baltimore Pike, and 320 south); **Longwood Gardens** in Kennett Square (17 miles south via US 1). See respective listings for complete details.

Malvern. **Swiss Pines** Charlestown Rd., R.D. 1, Malvern, Pennsylvania 19355 (215-933-6916). Established 1958. Owned and operated by the Bartschi Foundation, with Academy of Natural Sciences of Philadelphia. Guide for tour groups by reservation (charge). Information center with displays, book and gift shop. Brochure. Picnic areas and restaurants within 10 miles.

Hours 10 A.M.-4 P.M., weekdays, March 15-December 15; 9 A.M.-noon,



View of bridge and sculpture in Japanese Garden, Swiss Pines, Malvern.

Saturdays. Area 500 acres (11 developed). Staff of 6 (8). A series of gardens within a larger framework: Japanese garden (tea house, Shingon Pavilion, 70 stone sculptures), its plants unlabeled; rose garden; herb garden (110 kinds of culinary and aromatic herbs); heather and heath garden (200 varieties). Nature trails. Roman Tea House.

Specimen trees: many young ones, with the emphasis on Oriental species and conifers. Also bamboos, rhododendrons, dwarf conifers.

Directions Swiss Pines is 3 miles southwest of Phoenixville, 22 miles northwest of Philadelphia. Best route from Pennsylvania Turnpike Exit 24: south on Rte. 202, west on Rte. 30, then north on Rte. 29 to Charlestown Rd. (north again). From Tpke. Exit 23, south on Rte. 100, east on Rte. 30, then north on Rte. 29.

Longwood Gardens in Kennett Square is 17 miles south via Rtes. 29, 52. *See respective listing.*

Philadelphia. Arboretum of the Barnes Foundation Box 128, 300 Latche's Lane, Merion, Pennsylvania 19066 (215-664-8880). Established 1922. Privately endowed. Adult education program. Guided tours by appointment. Check-list of plants and occasional newsletters available on request. House contains well-known art collection.

Hours 9 A.M.-5 P.M., *by appointment.*
Area 12 acres. Staff of 9. **Kinds of plants** 2,500. Special collections: coto-neaster, magnolia, viburnum, peony. Peak display May 1-21. Dwarf conifer garden. A hundred-year-old fern-leaf beech. Fine Japanese clethra (*Clethra barbinervis*).

Directions Barnes Arboretum is 5 miles west of downtown Philadelphia in the suburb of Merion. Latche's Lane is off City Ave. Penn Central railroad (Merion Station), Route E bus to Arboretum.

Also nearby: **Haverford College** (Haverford, Pa.), which has a campus arboretum. College is northwest on Rte. 30 (Lancaster Ave.), left on College Ave.



The garden of heaths and heathers at the Morris Arboretum in Chestnut Hill.

Philadelphia. John Bartram's Garden 54th St. & Elmwood Ave., Philadelphia, Pennsylvania 19143 (215-729-5281). Started 1728, purchased by City in 1891. Operated by John Bartram Association (affiliated with Garden Club Federation of Pennsylvania) and Fairmount Park Commission. Bartram Association is a membership society. House and Garden admission 25 cents.

Hours 8 A.M.-4 P.M. **Area** 27 acres. Of historic interest as the home and garden of the leading American plant collector of the 18th century. None of the current trees appear to date from Bartram's time (1699-1777), but an aged yellow-wood and ginkgo were likely planted in son William's day (1737-1823). Trees unlabeled. Now a park, it was the site of America's first botanic garden of any note.

Directions Garden is in West Philadelphia, in an industrial area along the Schuylkill River. From downtown Philadelphia, go west on Walnut St., then left on 49th St., then right on Elmwood Ave. Allow 25-30 minutes from downtown.

Philadelphia. Morris Arboretum 9414 Meadowbrook Ave., Chestnut Hill (Philadelphia), Pennsylvania 19118. (215-247-5232). Opened in 1933 (tree collection dates to 1890's). Privately endowed; administered in conjunction with Biology Dept. of University of Pennsylvania. There is a membership organization. Quarterly: *Morris Arboretum Bulletin*. Brochure. Occasional lectures. Children's summer program sponsored by Pennsylvania Horticultural Society.

Hours 9 A.M.-4 P.M. weekdays, 9 A.M.-5 P.M. weekends. **Area** 175 acres. **Kinds of plants** 3,500. Staff of 20. An attractive mature arboretum with many fine trees and shrubs planted on a hillside location in the Philadelphia suburbs. Special collections: conifer, holly, witch-hazel, azalea. Heath, rose and medicinal gardens. Best time to visit: May-June; September-October. Remarkable and mature specimens of katsura-tree (*Cercidiphyllum japonicum*), Chinese elm (*Ulmus parvifolia*), lacebark pine (*Pinus bungeana*), various conifers. Many uncommon trees

Small fern house open on request.

Directions Arboretum is in Chestnut Hill section, 15 miles from downtown Philadelphia via Rte. 422A (Germantown Ave.), which borders the grounds and eventually intersects Pennsylvania Turnpike (Interchange #25, Norristown). Train & bus access: Pennsylvania and Reading railroads have Chestnut Hill terminals. From either station, "L" bus (from Broad & Olney) goes via Bethlehem Pike to Hillcrest Ave., also bordering Arboretum.

Also nearby: A 15-minute drive south of Morris Arboretum via Germantown Ave. and Washington Lane is **Awbury Arboretum** (Washington Lane & Ardleigh St.), a privately endowed park run by City Parks Assn. of Philadelphia. Dedicated in 1916. It has a black oak (*Quercus velutina*) said to be 250 years old; also, old specimens of river birch (*Betula nigra*) and little-leaf linden (*Tilia cordata*). Trees unlabeled.

Philadelphia. Pennsylvania Horticultural Society's 18th Century Garden 325 Walnut St., Philadelphia, Pennsylvania 19106 (215-922-4801). Established 1965.

Land owned by Independence National Historical Park; garden supported and managed by Pennsylvania Hort. Soc. Exhibits. Brochure 10 cents. Gift shop.

Hours Dawn-dusk. **Area** $\frac{1}{4}$ acre. Volunteer staff. Attractively recreated Colonial garden. Eighteenth-century model greenhouse with hobby plants (9 A.M.-5 P.M. weekdays).

Directions Garden is in historic area of downtown Philadelphia. Headquarters of the Pennsylvania Horticultural Society is adjacent to the garden.

Also in Philadelphia: Japanese Garden in West Fairmount Park (Lansdowne Dr.).

Pittsburgh. Phipps Conservatory Schenley Park, Pittsburgh, Pennsylvania 15213 (412-683-6080). Established 1893. City owned; operated by Dept. of Parks and Recreation, with support from Horticultural Fund of the Allegheny Conference on Community Development. Booklet \$1. Concession stand: guide books, postcards, slides. Picnic area in Park. Restaurants nearby.

Hours 9 A.M.-5 P.M. also 7 P.M.-9 P.M. during spring and autumn flower



Dwarf Conifer Garden in the Arboretum of The Barnes Foundation in Merion.



Planting around museum building, part of the Reading Public Museum Botanical Gardens in Reading, Pennsylvania.

shows, when there is a fee (50 cents adults, 10 cents children). Greenhouse shows: late March-mid-April; November. Christmas Show mid-December-late January. There are $2\frac{1}{2}$ acres under glass (12 display houses). Staff of 35. Collection of orchids from Laos and Thailand. Outdoors: large flower gardens; water-lily ponds.

Directions Schenley Park is in Civic Center of Pittsburgh, adjacent to Carnegie-Mellon University. From downtown area, take Blvd. of Allies east to Schenley Park, then follow "Oakland" signs, which lead to Conservatory.

Reading. Reading Public Museum Botanical Gardens 500 Museum Rd., Reading, Pennsylvania 19602 (215-373-1525) Established 1926. Operated by Reading School District. Children's program. Botanical exhibits in Museum. Brochure (trees). Gift shop. Picnic facilities and nearby West Reading playground.

Hours Sunrise-sunset. **Area** 25 acres. Staff of 4. Peony and formal gardens. Collections: cacti, tropical economic plants. Peak display: April-May (flowering trees and shrubs); June-August (annuals); September-October (chrysanthemums, autumn color). Gardens partly labeled.

Specimen trees: ginkgo, copper beech, cedar of Lebanon, little-leaf linden.

Directions Starting from Reading go 1 mile west on Rte. 422 from 5th Penn Sts., to 5th Ave. in West Reading. Turn left on 5th Ave., which eventually becomes Museum Rd. Reading is 55 miles northwest of Philadelphia.

Swarthmore. Arthur Hoyt Scott Horticultural Foundation Swarthmore College, Swarthmore, Pennsylvania 19088 Established 1929. Subsidiary of Swarthmore College (215-544-7900). Brochure. Guided tours by arrangement. Picnic area at Smedley Park, Baltimore Pike, Swarthmore.

Hours Dawn-dusk. Staff of 7. **Kinds of plants** 5,000. **Area** 300 acres. Special collections: lilac, rhododendron, cran-

apple, tree peony, magnolia. Rose garden. Peak arboretum display April-May. Specimen trees: scholar-tree (*Sophora japonica*); yellow-wood (*Cladrastis lutea*); pendent silver linden (*Tilia petiolaris*); sycamore (*Platanus occidentalis*); cucumber magnolia (*Magnolia acuminata*); evergreen sweet bay magnolia (*M. virginiana australis*); American elm.

Directions Arboretum is spread over the campus, which is 11 miles southwest of Philadelphia on Rte. 320 (Chester Rd.).

Also nearby: **Tyler Arboretum** (which see) in Lima (5 miles west via Rte. 320 north, Baltimore Pike south and US 1 south); also, Philadelphia area gardens.

Wallingford (Chester). Taylor Memorial Arboretum 10 Ridley Dr., Garden City, Wallingford, Pennsylvania 19086 (215-876-2649). Founded 1931, arboretum begun 1952. Operated by Board of Trustees under deed of Trust of the late Joshua C. Taylor. Brochure. Picnic area in adjacent Chester Park.

Hours Dawn-dusk. **Area** 32 acres. **Staff** of 3 (6). **Kinds of plants** 1,500.

Herb garden. Azaleas, hollies, camellias. Nature trails. Trials for suitable home plantings.

Directions Arboretum is immediately north of Chester in township of Wallingford. Best routes from nearby Philadelphia suburbs of Media and Swarthmore: Rtes. 252 or 320 south to their convergence. Right (west) turn on Harvey Rd. at 252-320 junction. Harvey Rd. leads into Ridley Dr.

Also nearby: See listings for Kennett Square, Lima and Swarthmore, Pa.; also Winterthur, Del.

Washington Crossing. Bowman's Hill Wildflower Preserve Washington Crossing State Park, Washington Crossing, Pennsylvania 18977 (215-493-4076). Established 1934. Operated by Washington Crossing Park Commission, Pa. Dept. of Forests and Waters. Support from local and regional groups. Brochure. Wildflower book \$1. Adult and children's programs. Nature exhibits in auditorium. Seed sale. Picnic area nearby.

Hours 9 A.M.-dusk. **Area** 100 acres. **Staff** of 3. **Kinds of plants** 1,000. All



Drive through Bowman's Hill Wildflower Preserve, Washington Crossing, Pennsylvania. Sphagnum Bog area is on the left and the Gentian Trail is at the right.

native plants of Pennsylvania are represented at Bowman's Hill in a series of trails. Trails: bluebell, gentian, azalea, medicinal, educational. Peak wildflower period April 15-June 1. Sphagnum bog. Native trees and ferns, including a 230-year-old hemlock (*Tsuga canadensis*).

Representative plants labeled.

Directions Preserve is $2\frac{1}{2}$ miles south of New Hope on Rte. 32 (River Rd.). New Hope is 27 miles north of Philadelphia on the Delaware River; 27 miles southwest of New Brunswick, New Jersey



National Trust for Historic Preservation by B&O

Boxwood edges formal tulip gardens of Woodlawn Plantation, Mount Vernon.

VIRGINIA

Boyce. O. E. White Research Arboretum Blandy Experimental Farm, University of Virginia, Box 85, Boyce, Virginia 22620 (703-837-1758). Established 1927. University jurisdiction.

Not officially open to the public, but interested visitors are welcome. **Area** 123 acres. Staff of 5. Fifty botanical families represented. Conifer collection. Plants are labeled. Best time to visit: late April-early May; mid-October.

Directions Arboretum is on Rte. 50, 12 miles east of Winchester, 60 miles west of Washington. Accommodations in Winchester.

Leesburg. Oatlands Rte. 2, Box 352, Leesburg, Virginia 22075 (703-777-3174). Federal-style mansion (ca. 1800) and furnishings and gardens were given in 1965 to the National Trust for Historic Preservation in the U.S. Guided tours. Horticultural Day picnic first Wednesday in May. Gift shop. Admission to house and garden: \$1, adults; 50 cents, children.

Group rates by arrangement. Brochure at door.

Hours 10 A.M.-5 P.M., April 1-October 31. **Area** 261 acres. Staff of 20 (including house). Early formal gardens; 150-year-old boxwood, 170-year-old English oak (*Quercus robur*). Peak display: late April-mid-June; October.

Directions Oatlands is 6 miles south of Leesburg via Rte. 15. Leesburg is 30 miles northwest of Washington, D.C.

Mount Vernon. Woodlawn Plantation Rte. 235, Mount Vernon, Virginia 22121 (703-780-3118). House built 1803-05; opened to the public in 1949. (Land given by George Washington as wedding gift to nephew who was his secretary-host.) Owned by National Trust for Historic Preservation in the U.S. (membership organization). Admission to house and gardens: \$1, adults; 50 cents, children. Group rates by arrangement. Brochure at house. Guided tours. Gift shop. Picnic area at nearby Grist Mill.

Hours 9:30 A.M.-4:30 P.M. (closed Christmas). **Area** 2,000 acres. Staff of 4 (plus guides). Peak garden display end



Day-lilies are part of summer display at Norfolk Botanical Gardens.



Terraces featuring boxwood and other specimen evergreens at Oatlands, Leesburg Va. The photograph above shows the area as it appeared around 1920.

of May. Collection of 19th-century roses. Copy of Mount Vernon Rose Garden. Handsome Camperdown elm (*Ulmus glabra* 'Camperdownii').

Directions Plantation is 3 miles west of Mount Vernon on Rte. 235 (14 miles south of Washington). AB&W bus to "Fort Belvoir" from Alexandria, Va. stops at gate.

Also nearby: **Kitchen Garden** at Mount Vernon restoration (Mount Vernon Memorial Highway).

Norfolk. Norfolk Botanical Gardens ("Gardens by the Sea") Airport Rd., Norfolk, Virginia 23518 (703-441-2435). Founded 1936 (2nd phase 1957). Operated by Norfolk Dept. of Parks and Recreation. Short courses for gardeners. Botanical Gardens Society programs. Guided tours on trackless trains and canal boats in season. Gift and book shops. Parking 25 cents. Picnic area and restaurant on premises.

Hours Dawn-dusk (building closed

Christmas). **Area** 220 acres. Staff of 4 (125). **Kinds of plants** about 700. Special gardens: fragrance garden for the blind; Japanese, holly and Colonial gardens. Azaleas, rhododendrons and camelias. Peak display: late April; summer. Site of International Azalea Festival. Small orchid house.

Directions To reach Gardens from Norfolk, follow Airport signs. Garden located just off Rte. 170.

Richmond. Gladsgay Gardens 631 Three Chopt Rd., Richmond, Virginia 23226 (703-353-8414, Dr. Wheelodon). Started 1958, privately owned. Annual plant sales (church benefit). Picnic area and restaurant nearby.

Hours Visitors by appointment. **Area** 5 acres. Staff of 4. A series of small gardens built around special themes and designed for year-round interest. Extensive collection of azaleas, particularly Glenn Dale, Gable, Kurume, Exbury hybrids; rhododendrons; other broadleaved



Marler

Georgian mansion and surrounding plantings at Oatlands as they appear today.

evergreens. Specimen trees: China-fir (*Cunninghamia lanceolata*), Oriental maples. Gardens are attached to a hobby nursery.

Directions Gladsgay Gardens are on the western edge of Richmond, near the country club. From center of Richmond, take Grove Ave. to Three Chopt Ave.

Also in Virginia: Colonial Williamsburg. The 18th-century restoration contains plants and gardens typical of the period.

WEST VIRGINIA

Morgantown. West Virginia University

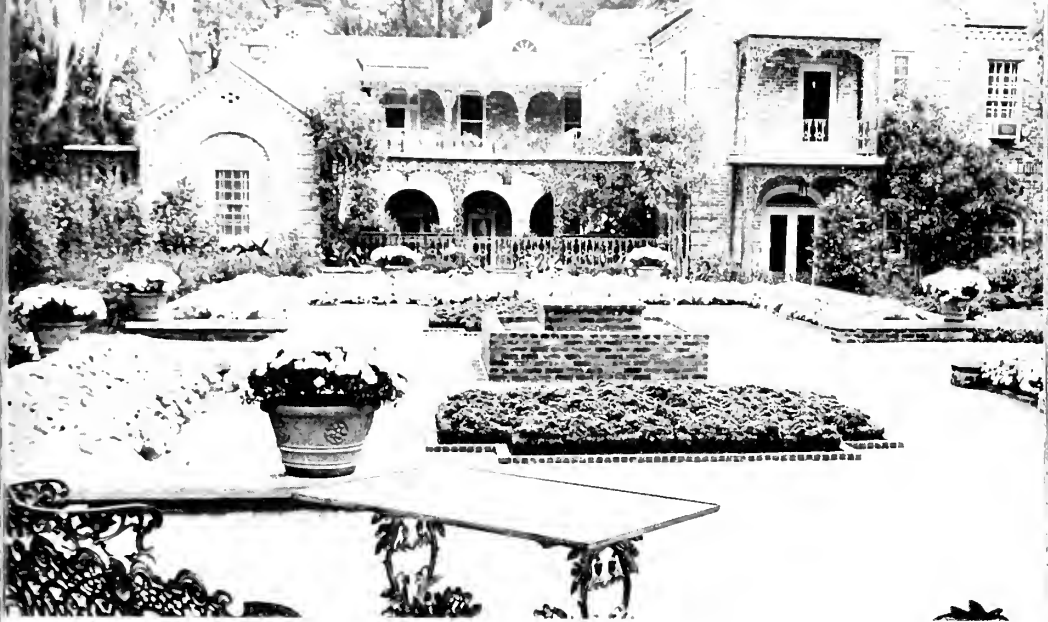
Arboretum Morgantown, West Virginia 26506 (304-293-0111). Established 1948. Operated by Biology Department. Brochure. Spring wildflower walks on last three Sundays in April, 2 p.m. Guided tours by arrangement. Arboretum quarterly newsletter (no charge). Restaurant and picnic area nearby.

Hours Dawn-dusk. **Area** 75 acres. Staff of 2. Shrub garden. Viburnum collection. There is 350-year-old chinquapin oak (*Quercus muhlenbergii*), said to be the third largest of its kind. Nature trails.

Directions Arboretum is located in city of Morgantown, on the Evansdale campus of West Virginia University.



Aged Chinquapin oak at West Virginia University Arboretum, Morgantown.



Chrysanthemums surround terrace at Bellingrath Gardens, Theodore, Alabama.

THE SOUTH

ALABAMA

Birmingham. Birmingham Botanical Gardens 2610 Lane Park Dr., Birmingham, Alabama 35203 (205-879-1576). Operated by Birmingham Park and Recreation Board. Supported by Birmingham Botanical Society (membership). Founded 1962. Picnic area and restaurants nearby.

Hours 9 A.M.-5:30 P.M. **Area** 67 acres. Staff of 21. Japanese Garden includes tea house, waterfalls and Zen garden. Attractive wildflower garden. "Touch and See" Garden under construction. Special plant groups: roses, iris, day-lilies. A 26-foot floral clock is of interest. Arboretum includes azaleas, dogwoods, uncommon trees and shrubs. Nature trail. Chrysanthemum and poinsettia shows.

Directions From interchange of Rtes. 31, 75 and Interstate 20, take Old Hwy. 280 south and follow signs to Gardens.

Theodore. Bellingrath Gardens Theodore, Alabama 36582 (205-973-2217). Opened to the public 1932. A former pri-

vate estate now operated by the Bellingrath-Morse Foundation. Admission to grounds: adults \$2.40, children 6-12 years of age \$1.20, under 6 free. Admission to mansion, which has antique collection, is \$3. Gift shop and restaurant (7:30 A.M.-5 P.M.). Brochure. Color booklet \$1.85 (mail).

Hours Gardens and greenhouse: 7 A.M.-6 P.M. in summer, to dusk in winter; mansion, 8:30 A.M.-5 P.M. (last tour 4:15 P.M.). **Area** 800 acres, 65 of which have been developed as gardens.

One of the major display gardens of the South. Some 250,000 azaleas (about 200 species and varieties) are the leading attraction from mid-January to April. Bellingrath is also noted for camellias (*Camellia japonica*, *C. sasanqua*), of which there are about 4,000 plants, some more than 100 years old. Camellias are in flower from September to April.

While azaleas and camellias form the peak displays in the cooler months, there are many other kinds of plants that add year-round or seasonal interest. Among them: African-violets in an open rock garden; lilies, water-lilies, roses, oleanders, gardenias, crape-myrtles, hibiscus, hydrangeas, dogwoods, mountain-laurels



One of the many water scenes at Florida Cypress Gardens in central Florida.

and *Michelia*. Nature trails, bird sanctuary. Although only the camellia arboretum is labeled, guides are stationed around the grounds to answer visitors' inquiries.

Directions Bellingrath Gardens is 20 miles south of Mobile. Directions from Mobile: Rte. 90 West or Interstate 10 to Theodore, then south on Rte. 59. Bellingrath is on the Isle-aux-Oies River, 10 miles north of the Gulf Coast. Gray Line Tours from 3 N. Royal St., Mobile.

Also nearby: Azaleas and canellias provide cool-month displays at two other Mobile-area gardens: **Clarke Gardens** 2100 Forest River Dr., 12 miles south via Rte. 163 and Boykin Blvd; **Earle W. Long Gardens** 250 Tuthill La., 7 miles west of Mobile via Spring Hill Ave. Ext. Each garden has a \$1 admission fee.

FLORIDA

Cypress Gardens. Florida Cypress Gardens Inc., Box 1, Cypress Gardens, Florida 33880 (813-293-2111). Started 1934. Privately owned. Admission: adults \$3, children 12-16 \$1.50, under 12 free. Brochure. Electric boat tours. Water-ski shows (10, 12, 2 and 4 o'clock). Aquarama. Gift shop. Picnic area and restaurant. Motel.

Hours 7:30 A.M.-6 P.M. **Area** 140 acres. Staff of 200. A well-known, in

fact archetypic, Florida tourist attraction, where plants form but one part of a larger scene. Gardens are constructed around a bald-cypress (*Taxodium distichum*) swamp on Lake Eloise. The emphasis is on winter-flowering plants, but attention has also been given year-round subtropical displays.

Bougainvillea, glory-bower, roses and azaleas are prominently represented; also horticultural oddities such as the sausage tree (*Kigelia pinnata*). Banyon-trees and other figs (*Ficus*). Cactus and rose gardens. Major plant displays labeled.

Directions Cypress Gardens, in the central part of Florida, is 4 miles south east of Winter Haven on Rte. 540.

Also nearby: **Slocum Water Garden** 1101 Cypress Gardens Rd. (Rte. 540) which has water-lily pools and conservatories. Admission fee. Closed Sunday.

Daytona Beach. **Bellevue Biblical Gardens** Bellevue Memorial Park, 1425 Bellevue Ave., Daytona Beach, Florida 3201 (904-253-2534). Dedicated 1962-63. Brochure. Guided tours for groups. Picnic area $\frac{1}{4}$ mile.

Hours Open continuously. Bible Garden is 1 acre of a larger memorial park. Staff of 2. Garden is laid out in chronological order based on the Scriptures and following the events in the li

of Christ. Trees include acacia; Holm oak (*Quercus ilex*); date palm (*Phoenix dactylifera*); pine tree grown from seed from Garden Tomb in Jerusalem; others.

Directions Gardens are west of Rte. 1 on Bellevue Ave.

Also in Daytona Beach: Marco Polo Park, 10 miles north, near intersection of Rte. 1 and Interstate 95. Large Japanese garden and commercial complex, including a simulated Japanese fishing village, opened 1970. Projects in progress: gardens of different nations; climatron-type greenhouse buildings; restaurants; shop. Admission fee.

Fort Myers. Thomas A. Edison Winter Home Botanical Gardens and Museum Rte. 867, Fort Myers, Florida 33901 (813-334-1281). House dates to 1886. City-owned. Admission: adults \$1.50, school-age students 50 cents. Special rates for groups. Conducted tours only. Museum of Edison inventions. Gift shop. Picnic area nearby.

Hours 9 A.M.-4 P.M.; Sundays 12:30 P.M.-4:30 P.M. **Area** 14 acres. **Kinds of plants** 500. Staff of 20 (total). The grounds are not strictly a botanic garden (rather a park in which the inventor planted a variety of mild-climate trees and shrubs). There are several kinds of ornamental fig trees (*Ficus*), including a massive banyon-tree (*F. benghalensis*) that Harvey Firestone gave Edison in 1925. It now has a circumference of 325 ft., counting its aerial rootlets.

Other plants of interest: kapok-tree (*Bombax malabaricum*); bamboo (*Bambusa*); sterculia; various palms and plumeria. Some plants labeled.

Even goldenrod is represented in the garden, for Edison was once keen on it as an alternate source of rubber. In fact, a car in the Museum has tires of goldenrod rubber. Museum depicts many of Edison's lesser known inventions, as well as his major ones. It is extensive, for Edison held 1,093 patents.

Directions The Edison Home is a short distance west of Fort Myers on Rte. 867.



Banyon-tree at the Thomas A. Edison Winter Home Botanical Gardens and Museum in Fort Myers, Florida.

Gainesville. Wilmot Memorial Gardens Dept. of Ornamental Horticulture, 105 Rolfs Hall, University of Florida, Gainesville, Florida 32601 (904-392-3261). Established 1953 as an outdoor laboratory for students. Picnic area and restaurants nearby.

Hours Open continuously; display greenhouse 8 A.M.-5 P.M. weekdays. **Area** 10 acres. Staff of 6. Main collections: camellia, azalea and juniper; also, palms that are hardy in northern Florida. Specimen trees; holly (*Ilex rotunda*), *Rhodolea championii*; others on main campus adjacent to Gardens. Greenhouse orchid collection. Nature trails. Peak display: mid-January to early March. Plants not labeled. A refinement and expansion program is planned in the 1970's.

Directions Gardens located at Archer and Stadium Rds. on campus.

Homestead. Orchid Jungle 26715 S.W. 157th Ave., Homestead, Florida 33030 (305-247-4824). Started 1923. Privately owned. Admission: adults \$1.50; children 10-14 75 cents; under 10, free. Guided tours for groups by reservation. Brochure. Publications: *Orchid News* (catalog) free; book, *Orchids for Home and Garden*, \$4.50. Gift shop. Picnic at nearby parks.

Hours 8:30 A.M.-5:30 P.M. **Area** 23

acres. Staff of 15. Orchids, bromeliads, aroids and other warm-climate plants in a lush setting in one of the mildest parts of Florida. Orchid Jungle is in a hammock (a dense thicket of hardwood trees growing a few inches above water level).

Native trees include southern live oak (*Quercus virginiana*); gumbo-limbo (*Bursera simaruba*); pigeon-plum (*Coccoloba diversifolia*). Strangler fig (*Ficus aurea*). Orchids are of year-round interest. Three greenhouses have bromeliads, aroids, other tropical plants. Nature trails.

Directions Orchid Jungle is 25 miles south of Miami via Rte. 1, then 1 mile west following signs. Gray Line bus tour to **Everglades National Park** from Miami stops here.

Homestead. Redland Fruit and Spice Park 24801 S.W. 187th Ave., Homestead, Florida 33030 (305-247-5727). Established 1944. Operated by Dade County Park and Recreation Dept. Guide booklet available. Guided tours twice weekly: Sunday at 3:30 P.M.; Wednesday at 10:30 A.M. Summer, Sunday only. Picnic area.

Hours 8 A.M.-5 P.M. weekdays; 10 A.M.-6 P.M. Sundays and holidays. **Area** 20 acres. Staff of 5. Tropical and subtropical fruits; mts and spices. Uncommon trees and shrubs. Special poison plant area. Best time to visit is from October to March.

Directions Park is 25 miles southwest of Miami via Rte. 1 to Princeton. Turn right (west) on Coconut Palm Dr. (248th St.) and drive 5 miles to intersection with S.W. 187th Ave.

Immokalee. Corkscrew Swamp Sanctuary Box 806, Rte. 846, Immokalee, Florida 33934. Established 1954. Maintained by National Audubon Society, a membership organization with headquarters at 1130 Fifth Ave., New York, N.Y. 10028 (212-369-2100). Admission: adults \$1.50; children under 12 free. Self-guided tour booklet (31 pages) included in admission charge.

Hours 9 A.M.-5 P.M. Closed major holidays. **Area** 6,080 acres. Staff of 6. The Sanctuary offers an educational experience rarely surpassed by the plant collections of man-made gardens.

A boardwalk more than a mile long leads into the swamp. Numbered markers along the boardwalk denote the main plants, and detailed information on these plants, based on the numbers, is given in the Sanctuary booklet. The Sanctuary's value is increased because few Florida gardens give much attention to native flora.

The stand of bald-cypress (*Taxodium distichum*) at Corkscrew Swamp is said to be the largest in existence. It is awesome and almost unreal in effect. The majestic trees are rivaled perhaps only by the redwoods and giant-sequoias of California.

Directions Corkscrew Swamp Sanctuary is in the Everglades on Rte. 846, about 30 miles southwest of Fort Myers.

Largo. Suncoast Botanical Garden 10410 125th St., N., Largo, Florida 33540 (mail to Mrs. G. K. Palmer, 5063 Dartmouth Ave. N., St. Petersburg 33710). Established 1962. Operated by Suncoast Botanical Garden, Inc., a membership society. Brochure. Adult instruction program. Guided tours by reservation. Seasonal plant sales. Periodical: *Buds*. Gift and book shop.

Hours Dawn-dusk. **Area** 60 acres (12 developed), leased from Pinellas County. Staff of 4. **Kinds of plants** 3,000. A garden-in-the-making. Young collections include eucalyptus, citrus, holly, magnolia, hibiscus, bromeliads. Subtropical flowering trees. Southwest Australian plants. Old specimen tree: black-gum or tupelo (*Nyssa sylvatica*).

Directions Garden is actually in the township of Seminole, several miles south of Largo. From Rte. 19A, go west on 102nd Ave. Continue to 125th St. N. Garden is about 13 miles northwest of downtown St. Petersburg.

Also nearby: Busch Gardens 3000 Busch Blvd., Tampa (813-988-8360). Display garden and zoo attached to Anheuser-



Palm trees are common in plantings at the Fairchild Tropical Garden in Miami.

Busch Brewery. No plants labeled. Parking \$1.

Miami (Coral Gables). **Fairchild Tropical Garden** 10901 Old Cutler Rd., Miami, Florida 33156 (305-667-1651). Founded 1936. Non-profit corporation, with support from membership. Admission: adults \$1; children under 16 free. Guide brochure 25 cents. Publication: *Fairchild Tropical Garden Quarterly Bulletin*.

Guided tours hourly (tractor train). School tours by appointment. Adult instruction program. Palm Products Museum. Book shop has many uncommon books on tropical horticulture. Snack bar. Picnic area nearby.

Hours 10 A.M.-5 P.M. (closed Christmas). **Area** 83 acres. **Kinds of plants** 2,500. Staff of 43. Special gardens: Montgomery Palmetum; Cycad Circle; Bahama planting; vine pergola; L. H. Bailey Palm Glade; rain forest; rock garden.

One of America's outstanding mild-climate gardens and a major botanic garden. The tourist and botanic traveler alike

will find much beauty in the attractively landscaped grounds. Palms are paramount, some 500 different species of them, representing one of the world's great collections.

Cycads, aroids, bromeliads, orchids and ferns also form important collections. Any time of year is a good time to visit (except the very hot days of summer) but the Garden is at its peak in spring and autumn. Rare plant conservatory (10 A.M.-4:30 P.M.).

Outstanding specimen trees: cannonball tree (*Couroupita guianensis*); triangle palm (*Necodypsis decaryi*); mammy-apple (*Mammea americana*); ponytail-tree (*Beaucarnea recurvata*); baobab (*Adansonia digitata*); sapodilla (*Manilkara zapota*); peach palm (*Bactris gasipaes*); *Microcynas calocoma*.

Directions Fairchild Garden is 7 miles south of downtown Miami via Rte. 1 south, then Lejeune Rd. south to Old Cutler Rd. Continue south to Garden.

Also nearby: **Vizcaya** 3251 S. Miami Ave., former estate of James Deering.



The Sarasota Jungle Gardens feature exotic birds as well as tropical gardens.

Palace with 10-acre formal garden, fountains, 10 A.M.-5 P.M. daily. Fee.

Miami. Japanese Garden on Watson Island, Dept. of Parks & Recreation, Miami, Florida 33133 (305-377-5586). Brochure. Picnic area on island.

Hours Dawn-dusk. **Area** 1 acre. An attractively designed garden, interesting in part for the mild-climate plants that have been substituted for the maples, azaleas and cryptomeria customarily seen in Japanese gardens in colder parts of the country. Singapore-holly (*Malpighia coccigera*), yew podocarpus (*Podocarpus macrophyllus*) and pittosporum (*Pittosporum tobira*) have an important role, although they are not pruned in a Japanese manner. Plants not labeled.

Directions Watson Island is on MacArthur Causeway between Miami and Miami Beach. Public transportation: C, K, or M buses.

Miami Beach. Miami Beach Garden Center and Conservatory 2000 Garden Center Dr., Miami Beach, Florida 33134 (305-534-7511). Operated by Miami Beach Parks Dept. Adult instruction program.

Hours 10 A.M.-4 P.M., except Thanksgiving, Christmas. **Kinds of plants** 2,300. Main collections: orchids and bromeliads.

Peak display: November through March.

Directions Garden Center is near the business center of Miami Beach, adjacent to the Auditorium and Convention Hall.

Sarasota. Sarasota Jungle Gardens 3701 Bayshore Rd., Sarasota, Florida 33580 (813-355-5305). Opened 1945. Privately owned. Admission: adults \$2; children (6-12) 75 cents, under 6 free. Guided tours for groups by reservation. Picnic area and restaurant.

Hours 8 A.M.-dusk. **Area** 15 acres. Staff of 26. **Kinds of plants** 4,000. A tourist attraction with free-roaming birds, including flamingos. Tropical "rain forest" of philodendrons, palms, bromeliads and other plants. Cactus and biblical gardens; others. Mild-climate fruit trees. Some plants labeled.

Directions Gardens are 2 miles north of Sarasota via Rte. 41. Follow directional signs from Rte. 41.

Also nearby: Ringling Museums 1 mile north via Rte. 41. Attractively landscaped 68-acre estate of the circus magnate, with an arboretum next to his former residence and a formal garden around the Art Museum. No plants labeled. Fee.

Naples. Jungle Larry's Safari at Caribbean Gardens Box 2505 (Fleischmann Blvd. at Goodlette Rd.), Naples, Florida 33940 (813-642-8901). Gardens begun in 1918, opened to the public in 1954. Privately owned. Admission: adults \$2; children 12-15 \$1; ages 3-11 50 cents. Folder. Picnic area.

Hours 9 A.M.-5 P.M. **Area** 30 acres. Staff of 19. **Kinds of plants** 350. A tourist attraction with a zoo of sorts—but at one time noted as the garden of plant hunter Dr. Henry Nehrling. Apart from the animal shows, there are mature ornamental fig trees (*Ficus*); royal palms (*Roystonea regia*, *R. elata*); *Phyllanthus emblica*; and trees and shrubs of southern Florida. Some plants labeled.

Directions Gardens are 2 miles north of Naples via Rte. 41. Entrance markers on Rte. 41.

GEORGIA

Athens. Founders Memorial Garden School of Environmental Design, University of Georgia, Athens, Georgia 30601 (404-542-1816). Established 1939; construction funds provided by the Garden Club of Georgia. Guided tours by appointment. Brochure. Garden has a museum of 18th- and 19th-century furniture. Restaurant and picnic areas nearby.

Hours 8 A.M.-5 P.M. **Area** 2½ acres. **Kinds of plants** 150. Staff of 3. Areas of special interest: boxwood, terrace and perennial gardens. Specimen trees: short-leaf pine (*Pinus echinata*), dove-tree (*Davidia involucrata*); yellow-wood (*Cladrastis lutea*); double-flowering dogwood (*Cornus florida* 'Pluribracteata'); southern magnolia (*Magnolia grandiflora*); oaks. Peak display from late March to early May.

Directions Garden is on campus, 2 blocks south of Broad St. (Rte. 78), facing Lumpkin St. (Rte. 441). Athens is 60 miles east of Atlanta.

Also nearby: University of Georgia Botanical Garden 3 miles from Athens on Whitehall Rd. Established 1969. A garden-in-the-making, partly financed by Georgia Horticultural Society Friends of the Garden and by the Garden Club of Georgia. **Area** 275 acres. Native plants of Georgia and others hardy in the Piedmont. Nature trails. Guided tours for groups by arrangement. Open daylight hours.

Fort Valley. Massee Lane Camellia Gardens of the American Camellia Society, Rte. 49, Fort Valley, Georgia 31030. Established 1932. Gardens supported by American Camellia Society Endowment Fund and by contributions. The Society is a membership organization and publishes the quarterly *Camellia Journal* and yearbook. Brochure. Camellia library; displays.

Hours 8:30 A.M.-5 P.M., Monday-Thursday. Open Friday and Sunday afternoons in season. Closed Saturdays. Greenhouse same hours. **Area** 160 acres (7 de-



View of Old Kitchen and Smoke House at Founders Memorial Garden, Athens.

veloped). Staff of 8. The flowering season is from October to April with peak bloom in February and early March.

Directions From Atlanta or Macon, take Interstate 75 south to Perry, then Rte. 127 west to Marshallville, then 3 miles north on Rte. 49. Accommodations in nearby Perry or Byron. Fort Valley is 85 miles southeast of Atlanta.

Pine Mountain. Callaway Gardens Rte. 27, Pine Mountain, Georgia 31822 (404-663-2281). Founded 1952. Privately endowed and administered by the Ida Cason Callaway Foundation. Admission: adults \$1, children 50 cents.

One of the South's leading recreation areas, with many activities of a non-horticultural nature: golf, swimming, tennis and other sports. Gardens include 12 lakes, 18 miles of road through natural woodland and landscaped grounds.

Various activities have special interest for gardeners. Adult workshops; seminars. Children's nature walks in summer. Display greenhouses. Guided tours.

Publications available by mail or at the Information Center: *Native Azaleas*, 85 cents; *Floral Guide*, 60 cents. Free bro-



Tuberous begonias are among seasonal displays at Lexington Cemetery, Kentucky.

chures on vegetable gardening; hollies; azaleas. Picnic areas, restaurants.

Hours 8 A.M.-7 P.M. **Area** 2,500 acres. Staff of 45. Of particular interest: azalea trail (peak flowering in mid-April); holly and rhododendron trails. Wildflowers. Seasonal display gardens. Vegetable garden of 7½-acres. Flowering quince and crab-apples complement the spring display. Crape-myrtle (*Lagerstroemia indica*) and late azalea (*Rhododendron prunifolium*) flower in July.

Directions Pine Mountain is 70 miles south of Atlanta, 27 miles north of Columbus. Accommodations: Callaway Cottages or Holiday Inn (from both, free admission to Gardens and guided bus tours). Air taxi from Atlanta or Columbus.

KENTUCKY

Clermont (Shepherdsville). Bernheim Forest Rte. 245, Clermont, Kentucky 40110 (602-543-2451). Established 1950. Privately endowed by the Isaac W. Bern-

heim Foundation. Garden club and home-maker programs, activities for school groups. Cooperative projects of a silvicultural or botanical nature with University of Kentucky and U. of Louisville. Exhibits. Arboretum center. General Forest folder. Picnic areas.

Hours 9 A.M.-dusk, March 15-November 15. **Area** 225 acres of a 10,000-acre forest preserve have been assigned for arboretum purposes. Staff of 3. Special gardens devoted to compact plants, also to plants having distinct sun or shade requirements. Hedge displays. Quiet Garden. Wildflowers. Nature trail. Best time to visit: April 1-May 31, October 7-21.

Plant collections: holly, dogwood, redbud, crab-apple, azalea, nut trees, others. Arboretum plans to develop synoptic and fragrance gardens, also children's garden.

Directions Bernheim Forest is 25 miles south of Louisville via Interstate 65, then 1 mile east of Rte. 245. Accommodations at Shepherdsville Interchange of Kentucky Turnpike, or in Bardstown.

Lexington. Lexington Cemetery 883 W. Main St., Lexington, Kentucky 40508. Established 1849 (flower garden 1963). Privately owned non-profit corporation. Restaurant nearby.

Hours 8 A.M.-5 P.M. Cemetery has 180 acres, flower garden, 4 acres. Gardening staff of 4. Spring-flowering trees, including dogwood, flowering cherries and peaches, redbud, crab-apples. Cemetery has a number of trees native to Kentucky, some over 100 years old. Venerable burr oak (*Quercus macrocarpa*).

Iris garden; sunken garden; hardy water-lilies and lotus. Annuals, chrysanthemums. Season-round displays. Not all plants are labeled.

Many well known Kentuckians, including Henry Clay and John C. Breckinridge, are buried in Lexington Cemetery.

Directions Cemetery entrance is 8/10 mile west of Fayette County Courthouse. Public transportation: City bus (Thompson Rd. bus) from center.

Also in Kentucky: Cave Hill Cemetery 701 Baxter Ave. (at eastern end of Broad-

way), Louisville. Also noted for its plantings.

LOUISIANA

Jefferson Island. Rip Van Winkle Gardens Jefferson Island, Louisiana 70545 (318-365-3631). House built in 1870 by actor Joseph Jefferson. Gardens under current owner date from 1945. Opened to public by J. Lyle Bayless Foundation in 1967. Admission: adults \$1.75; children 4-16 \$1, under 4 free. Brochure. Picnic area.

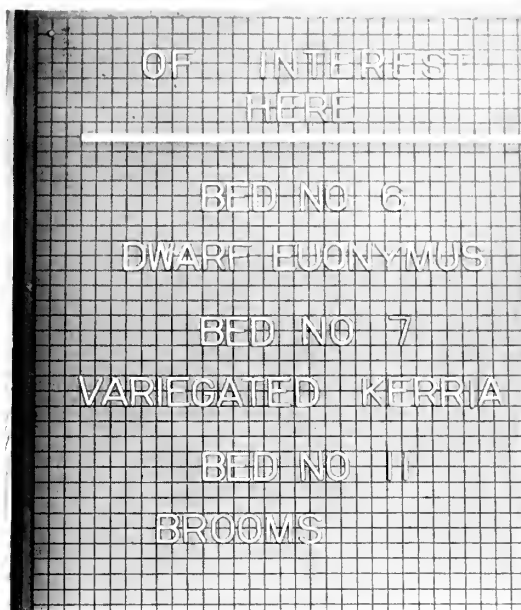
Hours 9 A.M.-5 P.M. **Area** 25 acres. Staff of 10. Formal gardens in English style, rose garden, rock garden. Special collections: camellia species and hybrids; Louisiana iris species and hybrids. Specimen trees: camphor-tree (*Cinnamomum camphora*); southern live oaks (*Quercus virginiana*) over 300 years old.

Gardens have been developed for year-round interest. Different paths used for different seasons. Two display greenhouses of orchids, camellias and tropical plants.

Directions Gardens are 7 miles southwest of New Iberia on Hwys. 675 and 14. Accommodations in New Iberia or Lafayette. New Iberia is about 50 miles southwest of Baton Rouge.

Many. Hodges Gardens Box 921, Rte. 171, Many, Louisiana 71449 (318-586-3576). Initially opened to the public in 1956; owned and operated by A. J. and Nona Trigg Hodges Foundation since 1960. Admission: \$2. Brochure. Guided tours by arrangement. Seasonal events. Gift shop. Surplus plants for sale at greenhouse. Restaurant and lodging (Hodges Gardens Motor Inn) across Hwy. Picnic area on grounds.

Hours 8 A.M.-dusk. **Area** 4,700 acres. Staff of 38. A series of display gardens developed for year-round interest. Areas of particular interest: camellia, azalea, rose, Louisiana iris and water-lily gardens. Spring bulbs. Wildflowers. Four display greenhouses include orchids, tropical ferns, *Anthurium andreanum*, gesneriads,



This sign board is changed weekly at the Bernheim Forest in Clermont, Kentucky.

hydrangeas, foliage plants and poinsettias.

Specimen trees: long-leaf pine (*Pinus palustris*); crape-myrtle (*Lagerstroemia indica*) in tree form; southern magnolia (*Magnolia grandiflora*). Waterfalls in old stone quarry. Wildlife refuge. Gardens partly labeled.

Peak display periods: March 15 to April 30 for spring flowers; May, roses; July-September, water-lilies; mid-October through November, chrysanthemums; November-March, camellias.

Directions Hodges Gardens, on Rte. 171, are about 65 miles south of Shreveport in western Louisiana, near the Texas border.

New Orleans. Longue-Vue-Gardens 7 Bamboo Rd., New Orleans, Louisiana 70124 (504-891-2419). Begun 1942; opened to public in 1968. Owned by the privately endowed Longue-Vue Foundation. A membership society is in formation. Admission: \$2. Guided tours by appoint-



The "Cleveland oak" of Rip Van Winkle Gardens, Jefferson Island, Louisiana.



Grove of loblolly pines in Chicot State Park, Ville Platte, Louisiana.

ment. Brochure. Picnic area in city park nearby.

Hours 10 A.M.-5 P.M. Friday, Saturday and Sunday. Others times for groups by arrangement. **Area** 8 acres. Staff of 4 (6). Longue-Vue is a garden-in-the-making. Currently, there is a series of five gardens, four of which are formal, including what is thought to be the only Spanish-type garden in Louisiana.

Wild garden has trees and shrubs native to the Gulf area. Camellias, azaleas, chrysanthemums. Small greenhouses. Peak displays occur in April-May and November. Gardens partly labeled.

Directions Gardens are a few minutes' drive from downtown Canal St. Drive up Canal St., turn left on Metairie Rd. then left again on Bamboo Rd. Metric bus stops one block from Gardens.

St. Francisville. Rosedown Plantation and Gardens Rte. 10, St. Francisville, Louisiana 70775 (504-635-3332). Mansion and gardens begun in 1835; restored 1956-1964. Privately owned. Admission: adults, mansion and grounds, \$3; grounds only, \$2. Children under 12, free on grounds; not admitted to house. Brochure. Booklet on mansion \$1.25 by mail. Picnic area 5 miles south in Audubon State Park.

Hours 9 A.M.-5 P.M., March-November; 10 A.M.-4 P.M. December-February.

Closed Christmas. **Area** 2,800 acres. Staff of 8. Antebellum plantation with elaborate gardens, original work buildings, completely refurbished mansion.

Old-fashioned garden plants are well represented at Rosedown. Century-old camellias and azaleas; gardenias; cypress (*Cupressus*) and redwood (*Sequoia*) sweet-olives (*Osmanthus*); crape-myrtle; deutzia and mock-orange. Kitchen and medicinal plant gardens.

Specimen trees, some of which are between 90 and 150 years old: live oak (*Quercus virginiana*); southern magnolia (*Magnolia grandiflora*); empress-tree (*Paulownia tomentosa*); Sawara-cypress (*Chamaecyparis pisifera*); others. Old oak avenue.

Directions Rosedown is just east of St. Francisville on Rtes. 10, 61. It is 30 miles north of Baton Rouge and 60 miles south of Natchez, Mississippi. Nearest accommodations are The Cottage Plantation in St. Francisville and Asphodel Plantation in Jackson.

Shreveport. R. S. Barnwell Memorial Garden and Art Center 501 River Parkway, Shreveport, Louisiana 71101 (318-422-8469). Founded 1970. Built by R. S. Barnwell, owned and operated by the City of Shreveport. Lectures, adult and children's art programs at Center.

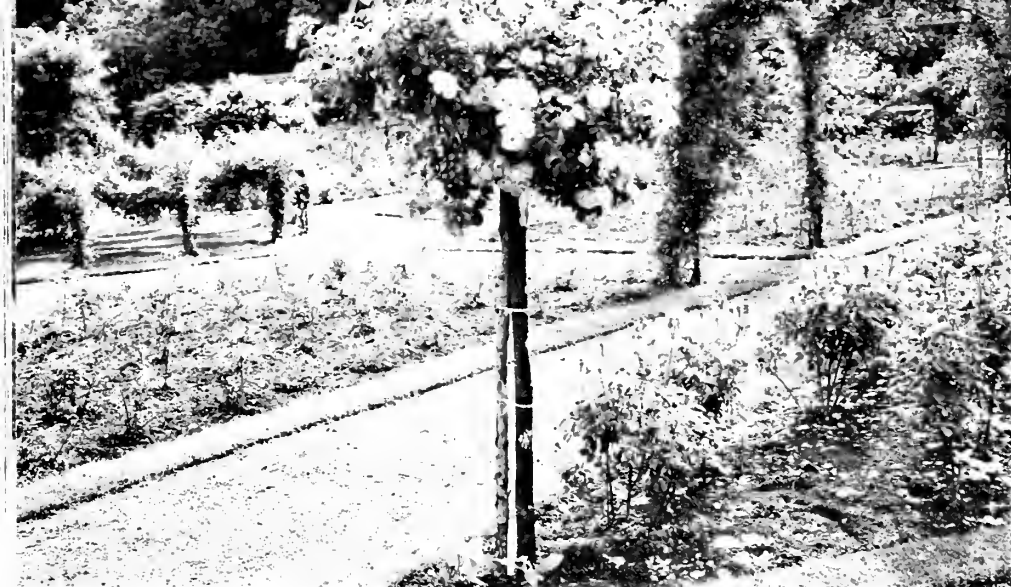
Hours 9 A.M.-4 P.M., weekdays; 1



One of the landscaped display gardens at the Hodges Gardens, Many, Louisiana.



Borders of caladiums, Rosedown Plantation and Gardens, St. Francisville, Louisiana.



The formal rose garden at the Biltmore Estate in Asheville, North Carolina.

P.M.-5 P.M., weekends. **Area** 2 acres. Staff of 5. A new garden pleasantly situated on the banks of the Red River. There are plans for a magnolia arboretum and for native plant trails along the river. Small greenhouse.

Directions Garden is at the foot of Milam St., on River Pkwy. Motor inn and restaurant 2 blocks away.

Ville Platte. Louisiana Arboretum Chicot State Park, Ville Platte, Louisiana (mailing address: c/o Mr. N. A. Tuzzolino, P.O. Drawer 1111, Baton Rouge 70821). Operated by Louisiana State Parks and Recreation Commission (504-389-5761). Brochure. Picnic area in adjacent part of Park.

Hours Open continuously. **Area** 301 acres. A woodland arboretum with 7 nature trails. Specimen trees: southern magnolia (*Magnolia grandiflora*) and American beech (*Fagus grandifolia*). Native shrubs. Best time to visit: mid-March to mid-April; mid-September to mid-October.

Directions Arboretum is 7 miles north of Ville Platte, off Rte. 167. Accommodations in Ville Platte; also, cabins in Chicot State Park. Arboretum is about 70 miles northwest of Baton Rouge.

NORTH CAROLINA

Asheville. Biltmore Estate Box 5375, Asheville, North Carolina 28803 (704-253-4411). Opened to the public 1930 (house and gardens date from 1890's). Privately owned. Admission to Biltmore House, actually a 365-room chateau, and gardens: adults \$3; children over 6 \$1.50. All tours self-conducted.

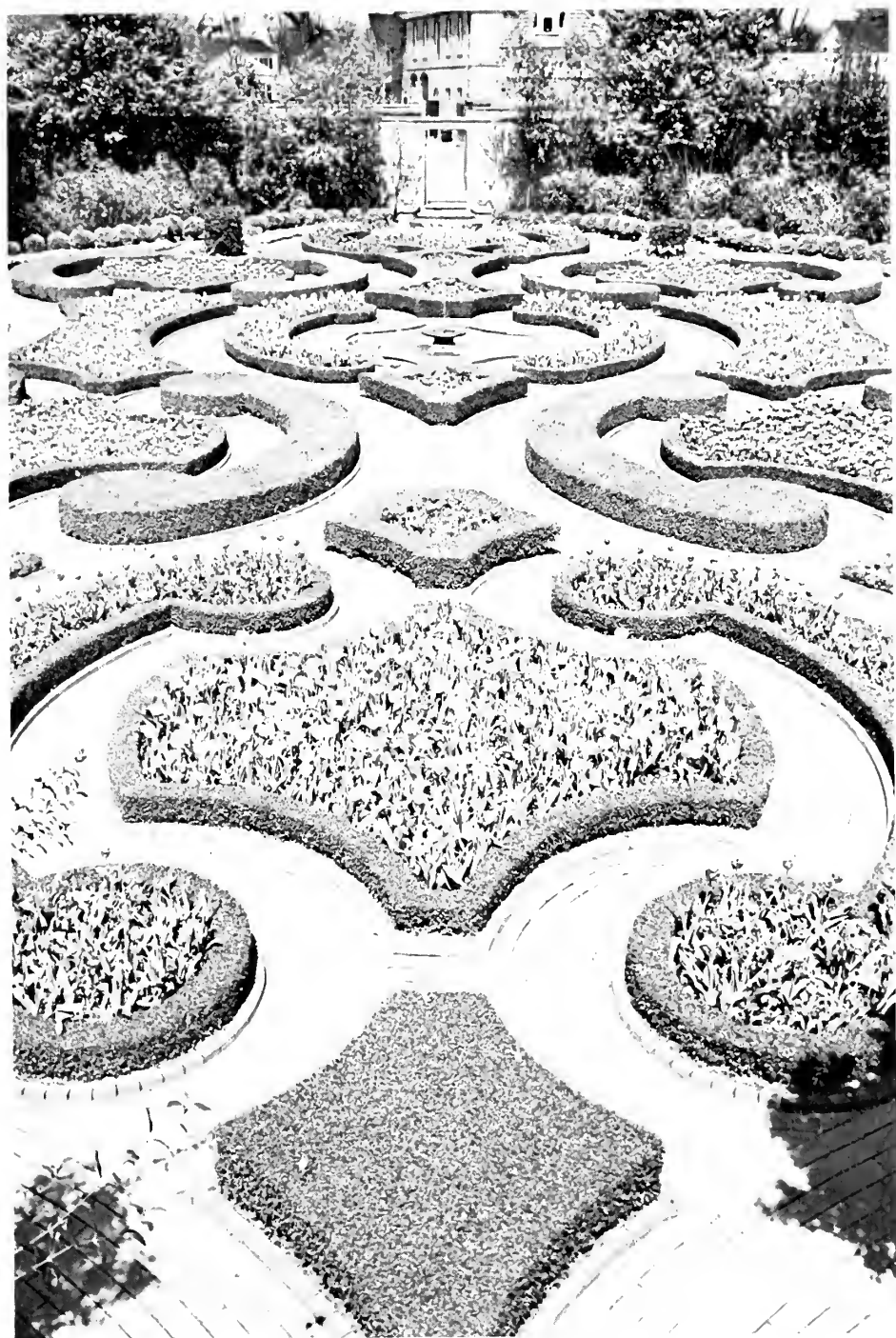
Brochure. Color guidebook \$1.50. Picnic area by reservation. Milk bar.

Hours 9 A.M.-6 P.M. Closed December 15-February 1. Grounds (11,000 acres) are remainder of original 125,000-acre estate of George Washington Vanderbilt. There are 35 acres of formal gardens. Arboretum designed by Frederiek Law Olmsted, who also planned New York City's Central Park.

Of special interest: 4-acre walled English garden; Italian, rose and azalea gardens; spring bulbs; peonies, iris. Greenhouse orchid display.

Directions Estate is 2 miles south of Asheville via Rte. 25. Directional signs from main road.

Durham. Sarah P. Duke Gardens Duke University, Durham, North Carolina



Jim Page

Maude Moore Latham Memorial Garden of Tryon Palace in New Bern.



The old "Live Oak Avenue" at Brookgreen Gardens, Murrells Inlet, South Carolina.

27706 (919-684-8111). Founded 1934. Privately endowed. Tours for groups by appointment. Brochure.

Hours 8 A.M.-dusk. **Area** 55 acres. Staff of 10. Special gardens: rose; rock; formal terrace; iris; water; woodland; others. Peak displays: April to mid-May. Chrysanthemums in October. Few plants labeled.

Directions Garden is next to Duke Hospital and West Campus entrance. Durham is 30 miles northwest of Raleigh.

Winnabow. Orton Plantation Gardens Winnabow, North Carolina (tel. 919-763-8587). Mailing address: Box 3625, Wilmington, N.C. 28401. Privately owned. Greek Revival house (not open to public). Gardens established in 1910. Admission fee. Brochure. Plant sales. Picnic area nearby.

Hours 8 A.M.-6 P.M., spring and summer; 8 A.M.-5 P.M., autumn and winter. Fifteen acres of gardens along Cape Fear River. Staff of 6. Areas of special interest: stroll, sun and white gardens; water scene. Azaleas. Peak display in April. Annuals.

Old specimen trees include southern live oak (*Quercus virginiana*); loblolly pine (*Pinus taeda*); camphor-tree (*Cinnamomum camphora*); others. Gardens not completely labeled.

Directions Gardens are 17 miles south of Wilmington, N.C. via Rte. 133.

Winston-Salem. Reynolda Gardens of Wake Forest University Reynolda Rd., Winston-Salem, North Carolina 27109 (919-725-9711). Established 1958. Endowed by Mary Reynolda Babcock Foundation.

Gardens form one part of a larger scene. **Winston-Salem Nature Center**, which has educational displays and programs, is on the same property. Gardens also surround a 17-acre tract that includes **Reynolda House**, a museum of American art (admission: adults \$1, students 50 cents). Land was once estate of tobacco manufacturer R. J. Reynolds.

Garden hours Dawn-dusk. **Area** 110 acres. Staff of 7. About 1,000 kinds of plants. Four-acre formal garden has boxwood, flowering cherries, Asiatic magnolias, lily-turf (*Liriope*). Special collections: prostrate junipers, holly.

Specimen trees: cryptomeria, bald-eyepress and weeping cherries. Nature trails. Gardens partly labeled. Best time to visit: April-May; October. Greenhouse has garden varieties of English ivy (*Hedera helix*), *Zephyranthes*.

Directions From Interstate 40, go north on Silas Creek Parkway to Reynolda Rd. Turn right to Gardens.

Also in North Carolina: Tryon Palace 1618 Pollock St., New Bern. State capitol from 1768-1777. Restoration (1950-1959) has gardens of English design containing variety of plants that would have been used in 18th century. Peak flowering: March 15-April 1. Closed Monday. Fee.

SOUTH CAROLINA

Charleston. Magnolia Gardens Rte. 4, Charleston, South Carolina 29407 (803-766-3464). Main collections begun in 1850. Privately owned. Home of nine generations of Drayton family since 1672. Admission: adults \$2.50; children under 12 free. Brochure. Picnic area nearby.

Hours 8 A.M.-5 P.M., February 15-May 1. Estate of 85 acres includes 25 acres of garden and 16 acres of lawn. Remaining land is devoted to a nursery. Staff of 8.

Camellias planted as early as 1843 and indica azaleas in 1848, but the main collections date from 1851 when Reverend John Grimke-Drayton became interested in these plants. Peak bloom: last week of March to about April 10. Magnolias, live oaks, bald-cypress.

Directions Gardens are 10 miles northwest of Charleston via Rte. 61, then Rte. 4. Gray Line bus tours from Charleston. Gardens are near **Middleton Place** (see below).

Charleston. Middleton Place Rte. 4, Charleston, South Carolina 29407 (803-766-3661). Gardens begun in 1741. Original home of Henry Middleton, president of first Continental Congress. Privately owned by descendants.

Admission: adults \$2.50, students \$1.50. Group rates. Brochure. Guided tours for groups by appointment. Displays of 18th- and 19th-century craft and farm-related artifacts. Plantation stable-yards illustrate 18th-century plantation life. Gift shop. Restaurant. Picnic area adjacent.

Hours 8 A.M.-5 P.M. Sixty-five acres of 6,000-acre estate are open to public. Staff of 18. Thought to be oldest landscape garden in U.S. An outstanding plantation with mass displays of camellias and azaleas. Points of special interest: the octagonal, moon, secret, sundial and camellia gardens.

Garden has many fine southern magnolias. The magnificent "Middleton oak"—a southern live oak (*Quercus virginiana*)—may be nearing 1,000 years, according to the Charleston Museum. Camellias said to



A curiosity, the "elephant's foot" camellia at Middleton Place, Charleston.

have been planted here in the late 18th-century by French plant explorer André Michaux are still thriving.

Trails lead off from the older, more formal sections of the garden and wind around a bald-cypress lake and through natural woods above the Rice Mill pond.

Directions Middleton Place is 14 miles northwest of Charleston on Rte. 61. It is a few minutes drive from Magnolia Gardens (see above). Gray Line bus tours from Charleston.

Murrells Inlet. Brookgreen Gardens (a Society for the Southeastern Flora and Fauna), Murrells Inlet, South Carolina 29576 (803-237-4657). Privately endowed. Founded 1931 as a setting for 19th-century American sculpture. Admission: adults 50 cents, children 25 cents. Brochure. Picnic area.

Hours 9 A.M.-4:45 P.M. Closed Christmas. **Area** 10,000-acre preserve, 300 of which are open to the public. Staff of 30. **Kinds of plants** 700. Emphasis on hollies and oaks. Old live oak (*Quercus virginiana*) avenue. Dogwood and palmetto gardens. Landscaped statuary gardens have 340 works of sculpture by 178 artists.

Magnolia, crape-myrtle, oleander, camellia, jasmine and azaleas are well represented at Brookgreen. Atamasco-lily (*Zephyranthes atamasco*) and other spring wildflowers. Wildlife sanctuary; small zoo. Peak flowering displays: first

two weeks of April.

Directions Brookgreen Gardens is in the Carolina Low Country on Rte. 17, midway between Myrtle Beach and Georgetown. Accommodations in Myrtle Beach, Litchfield Beach or Georgetown. Murrells Inlet is 65 miles northeast of Charleston.

Oakley (Charleston). Cypress Gardens Box 116, Oakley, South Carolina 29466 (803-553-0515). Opened 1930; given to City of Charleston by B. R. Kittridge family in 1963. Operated by independent board under City Council.

Admission: adults \$2.50, children over 12 \$1.50; under 12 free. Forty-five-minute boat ride through bald-cypress lagoon is 50 cents extra. Group rates. Brochure at gate. Garden books for sale at ticket office. Picnic area on premises. Tearoom.

Hours 8 A.M.-dusk, February 15-May 1. **Area** 162 acres. Staff of 9 (19). Most imposing "exhibit"—aged and immense

bald-cypress trees (*Taxodium distichum*) in their natural habitat. Masses of azaleas (more than 40 kinds) and camellias (300 garden varieties) in the drier spots. Peak flowering display: March 15 to April 15.

Directions Cypress Gardens is 24 miles north of Charleston, off Rte. 52. Bus tours from Charleston.

Orangeburg. Edisto Memorial Gardens Box 863, Rte. 301 South, Orangeburg, South Carolina 29115 (803-534-6376). Founded 1927. Operated by City Parks Dept. Brochure. Tours for interested groups by appointment. Picnic area nearby.

Hours Open continuously. **Area** 90 acres. Staff of 18. Rose garden of 5,000 bushes, with bloom starting in mid-April. Also azaleas, camellias, crab-apples, dogwood. Day-lilies. Nature trails.

Directions Gardens are on Rte. 301 South, within city limits of Orangeburg, about 70 miles northwest of Charleston.



J. B. Collins

One of scenic views from drive through Reflection Riding, a preserve in Tennessee.

TENNESSEE

Chattanooga. Reflection Riding (mailing address: 518 Maclellan Bldg., Chattanooga 37402). Located at junction of U.S. Rtes. 11-41-64-72 with State Rte. 148 (Lookout Mountain Scenic Highway). Established 1956. Privately endowed. Admission: \$1 per car. Brochure.

Hours 7:30 A.M., summer; 8 A.M.-6 P.M., winter. **Area** 300 acres. Staff of 2. A wildflower preserve to be viewed by car via 3-mile scenic drive on Lookout Mountain. Markers give background information. Shadblow (*Amelanchier*); dogwood; azaleas; other native plants. Partly labeled. Best times to visit: March-April; October-November.

Directions Reflection Riding is 6 miles southwest of downtown Chattanooga.

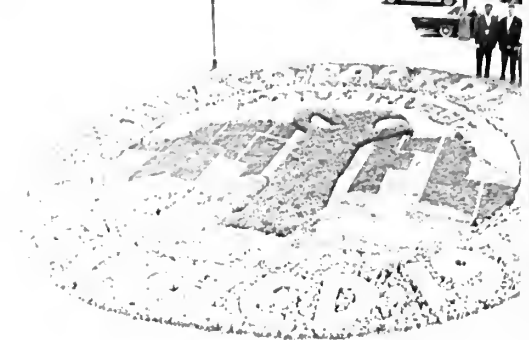
Memphis. Memphis Botanic Garden 750 Cherry Rd., Memphis, Tennessee 38117 (901-685-1566). Founded in 1947 as W. C. Paul Arboretum. Operated by Memphis Park Commission, with some financial support from membership. Descriptive map. Monthly publication to members. Adult instruction program. Guided tours for groups by reservation. Picnic area.

Hours 9 A.M.-5 P.M. (Sunday 2 P.M.-5 P.M.). **Area** 100 acres. Staff of 18. Points of special interest: rose, iris, wildflower, Japanese and magnolia gardens. Arboretum has azaleas; hollies; crab-apples; other trees and shrubs. Also daffodils; day-lilies; dahlias.

Garden has camellia houses and tropical conservatory. Collections partly labeled. Best time to visit: April-May; September-October.

Directions Memphis Botanic Garden is part of **Audubon Park**. Garden headquarters is Goldsmith Civic Garden Center in Park.

Nashville. Tennessee Botanical Gardens and Fine Arts Center Cheekwood, Cheek Rd., Nashville, Tenn. 37205. Established 1960. Privately operated, with support from membership. Admission: adults 50



Plants depict seal of Chicago Park District at Garfield Park Conservatory.

cents, children 25 cents. Georgian mansion (1930). Adult short courses in landscape design and flower arranging. Brochure. Book, *Trees of Christmas*, \$8.30 by mail. Tea-room. Gift shop.

Hours 10 A.M.-5 P.M., Tuesday-Saturday; 1 P.M.-5 P.M., Sunday. Closed Thanksgiving, Christmas, New Year's Day. **Area** 55 acres. Staff of 8. Memorial shrub garden. Camellias. New holly and crab-apple arboretum. Wildflowers; daffodils; iris and day-lilies. Old boxwood. Two greenhouses. Nature trail.

Gardens are in a period of transition, with major construction underway. Plans include a garden for the blind.

Directions Gardens are 7 miles west of Nashville on Cheek Rd., off Rte. 100.

Oak Ridge. University of Tennessee Arboretum 794 Bethel Valley Rd., Oak Ridge, Tennessee 37830 (615-483-8721). Established 1964. University-operated, with limited financial support from Arboretum Society. Guided tours. Brochure. Publication: *Arboretum Society Bulletin* (twice yearly). Plant sale. Picnic areas in nearby parks.

Hours 8 A.M.-4 P.M. weekdays. **Area** 250 acres (25 cultivated). Staff of 5. **Kinds of plants** 600. Holly garden; heath cove; shrub garden. Dwarf conifers, magnolias. Weeping hemlock variant (*Tsuga canadensis*, Valentine clone). Nature trails (printed guide available). Peak display: April-May.

Directions Bethel Valley Rd. is off Rte. 62, east of Oak Ridge. Arboretum is about 20 miles west of Knoxville.

THE GREAT LAKES REGION

ILLINOIS

Chicago. Garfield Park Conservatory 300 N. Central Park Blvd., Chicago, Illinois 60624 (312-533-1281). Established 1907. Operated by Chicago Park District. Guided tours and lectures for groups by appointment. Brochure. Also, *Plant of the Month* mimeographed sheets and illustrated brochures for flower shows.

Hours 9 A.M.-5 P.M. During special shows, open until 9 P.M. Four acres under glass in a 20-acre area of Park. Staff of 70 (90). **Kinds of plants** 4,000. One of America's most outstanding gardens under glass. Individual conservatories house palms, ferns, economic plants, aroids, cacti and other succulents. There are also two display conservatories, of which one is re-done each year to follow a special theme for the year.

Ideal times to visit are during seasonal shows: chrysanthemums in November; Christmas display in last two weeks of December; Azalea Show about February 15-March 15. Easter Show starts Good Friday and runs four weeks.

Outdoors: formal bedding gardens; garden for the blind. Two pools contain 50 varieties of water-lilies.

Directions Garfield Park is on Chicago's West Side. By car, take Eisenhower Expressway to Independence Blvd. Go north to Lake St., then east to Conservatory parking lot. Public transportation: C.T.A. Washington Blvd. bus or any Lake St. bus to Central Park Ave., then walk north. By train, any "B" train on Lake St. "el" to Homan Ave. station.

Chicago. Lincoln Park Conservatory 2400 N. Stockton Dr., Chicago, Illinois 60614 (312-549-3006). Operated by Chicago Park District. Guided tours for groups by appointment. Brochure. Picnic area in park. Restaurant nearby.

Hours 9 A.M.-5 P.M. During special

shows, 9 A.M.-9 P.M. Staff of 44. Three acres. Points of particular interest: palm house, fernery, tropical house, seasonal displays.

Outdoors: Main Garden (8 flower beds); Grandmother's Garden (old-time annuals and perennials); rock garden.

Directions Lincoln Park is in the north end of the city. From central Chicago, take Lake Shore Dr. to Fullerton Pkwy., then go 1 block west to Conservatory. Public transportation: take any of the following bus routes: Diversey, Wilson-LaSalle, Wilson-Michigan, Clark, Broadway, Lincoln-Wabash, Taylor-Sedgwick-Sheffield, Armitage or Ogden. Then walk east to Conservatory.

Also in Chicago: Chicago Park District, with headquarters at 425 E. 14th Blvd., Chicago 60605 (312-427-5252) operates 14 gardens. In addition to the ones in Garfield and Lincoln Parks, there are **Jackson Park Perennial Garden** (59th St. & Stony Island Ave.); **Marquette Park** rose and test gardens (3450 W. 71st St.); **Grant Park Rose Garden** (between Randolph St. and 14th Blvd.); **Douglas Park Formal Garden** (south of Ogden Ave. and east of Sacramento Blvd.); others. Park District issues a folder covering these gardens, also a map.

Glencoe (Chicago). Chicago Botanic Garden (Botanic Garden of the Chicago Horticultural Society), Box 90, 775 Dundee Rd., Glencoe, Illinois 60022 (312-835-5360). Established 1965, with much still in the planning stage. Operated by Chicago Horticultural Society, with tax support through the Forest Preserve District of Cook County, and from membership and private contributions.

Admission free until official opening, expected in the mid-1970's. Guided tours and lectures. Brochure, gift and book shop, and restaurant are all anticipated. Current publication: *Garden Talk* (for members of Chicago Horticultural Society). Picnic area at Forest Preserve Lane, 1/4 mile east.

Hours 8 A.M.-4:30 P.M., Monday-Friday. **Area** 300 acres, including 60 acres

of lakes and seven islands. A major botanic garden-in-the-making—on land that was once part of the Skokie Marsh. Recently completed: Home Landscape Center, a series of small gardens suitable for the Chicago area.

Directions Botanic Garden is 21 miles north of Chicago. Best route from metropolitan area: John F. Kennedy Expressway (Rte. 94) north. Continue north on Rte. 94, then take Lake-Cook exit and proceed east $\frac{1}{4}$ mile to Garden entrance.

The **Chicago Horticultural Society** has its own headquarters in a building at 116 S. Michigan Ave., Chicago 60603 (312-332-2868).

Lisle. The Morton Arboretum Lisle, Illinois 60532 (312-968-0074). Established 1922. Privately endowed. Admission: 50 cents per car to drive in Arboretum; no charge to walk. Year-round adult and children's instruction programs. Open-air bus tours, lectures and photographic programs scheduled for public from late April through early June and during October. Tours for groups by appointment.

Brochure and schedules available from

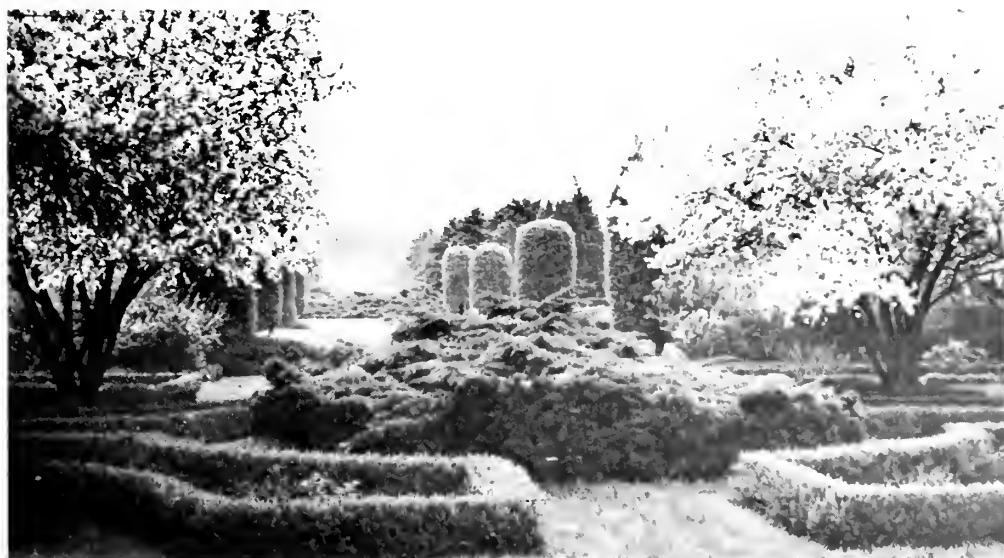
Public Information Office; also maps, trail guides and other publications. Periodical: *The Morton Arboretum Quarterly*. Picnic area adjacent, 11 A.M.–3:30 P.M. except winter. Restaurant planned for 1972.

Hours 8 A.M.–7 P.M. May–October; 8 A.M.–5 P.M. rest of year. Building closed holidays, also Sundays from November to mid-April. **Area** 1,500 acres. Staff of 60 (120). About 4,800 kinds of plants.

A major arboretum with an extensive collection of woody plants, especially cultivars. There are miles of woodland roads; visiting by car is recommended if all major points are to be seen. Of special interest: hedge and street tree areas, prairie restoration project. Other collections are arranged botanically, geographically, or according to landscape qualities.

Morton Arboretum is known for its flowering crab-apples, lilacs and conifers. Ground covers. Nature trails. Peak flowering display is from late April to mid-May; autumn color in October.

Directions Arboretum is 25 miles west of Chicago at intersection of Rte. 53 and East-West Tollway. Accommodations nearby in Downers Grove or Glen Ellyn.



Flowering crab-apples are highlights in evergreen garden at Morton Arboretum.



THE MAKING OF A BOTANIC GARDEN Above: Site of the Chicago Horticultural Society's Botanic Garden in November, 1967. Below: Same site, 2 years later.



INDIANA

Lafayette. Jerry E. Clegg Botanical den Rural Route 12—Box 246, Lafayette, Indiana 47905. Established 1965. Privately endowed, with support from membership. Operated by Foundation Board. Trail maps available. Restaurant nearby on Rte. 52.

Hours 10 A.M.-dusk. **Area** 14 acres. Staff of 3, plus volunteers. **Kinds of plants** 300. A woodland arboretum on the high bank side of Wildcat Creek. There is over a mile of trails in rugged land cut by ravines that are crossed by foot bridges.

Peak wildflower period is from mid-April to mid-May. Japanese anemone and Hall's-amaryllis (*Lycoris squamigera*) in August. Along the trails are old white oaks, dogwood, sugar maples and in the spring daffodils.

Directions From Rte. 52 By-Pass, take Rte. 25 north to Road 300 North. Turn right and continue to intersection with Road 400 East. Turn right and drive 1.1 mile to parking lot.

Michigan City. International Friendship Gardens Michigan City, Indiana 46360 (219-874-3664). Started 1934. Non-profit organization. Occasional cultural programs. Brochure and calendar of events. Admission: adults \$1, children 50 cents.

Hours 9 A.M.-dusk, early May-late summer. **Area** 100 acres. Continuous flower display in the warmer months. Tulips, roses, delphinium, phlox, hibiscus, bedding plants. Autumn rose show. "Gardens of Many Nations."

Directions Gardens are in Pottawatomie Park, 1½ miles east of Michigan City on Rte. 12. Enter at Liberty Trail and follow signs. Gardens are 52 miles east of Chicago.

Muncie. Christy Woods of Ball State University Muncie, Indiana 47306 (317-289-1241). Established 1918. University-operated. Guided tours for school and



The Jerry E. Clegg Botanical Garden is on the high-bank side of Wildcat Creek.

community groups. Picnic area and restaurant nearby.

Hours 7:30 A.M.-5 P.M. weekdays, 8 A.M.-4 P.M. Saturday, 2 P.M.-4 P.M. Sunday. **Area** 18 acres. Staff of 4. Primarily a woodland arboretum with about 100 kinds of native trees and shrubs along the trails (University bookstore sells *Spring Wild Flowers of Christy Woods*).

Cultivated area has iris, peonies and chrysanthemums. Orchid greenhouse. Collections partly labeled. Best months to visit are April, May, October.

Directions Ball State University is 1 mile northwest of Muncie, on Riverside & University Aves. Christy Woods is across the street from the Student Center.

Richmond. Hayes Regional Arboretum 801 Elks Rd., Richmond, Indiana 47374 (317-962-3745). Established 1959. Former estate of Stanley W. Hayes, with plantings from 1915. Now operated by the Hayes Foundation. Nature education programs for children and adults. Nature

center building is a re-modeled 100-year-old dairy barn. Guided tours for groups. Brochure. Picnic areas and restaurants nearby.

Hours 10 A.M.-4 P.M. Monday-Saturday; 12 noon-5 P.M. Sunday. Closed Mondays and first two weeks of September. **Area** 300 acres. Staff of 8 (23). There are 140 species of native trees and shrubs.

A woodland arboretum part of which is beech-maple climax forest. One area has tulip-tree, white ash, white oak and other native trees that were planted close together 40 years ago to simulate forest conditions, while another area, planted at the same time, has similar trees that were set far enough apart so that they would develop their characteristic shape. Fern garden. Ideal times to visit are the last two weeks of April and the middle two weeks of October.

Directions Arboretum is 4 miles east of Richmond, with entrance on Elks Rd. $\frac{1}{2}$ mile north of Rte. 40. Richmond is 50 miles east of Indianapolis and is near the Ohio state line.

Wabash. Honeywell Gardens Box 432, Wabash, Indiana 46992 (219-563-3440). Begun as private garden in 1930 by industrialist Mark C. Honeywell, opened to the public in 1963. Privately endowed by the Honeywell Foundation. Guided tours. Children's and adult education program. Brochure. Cultural events. Picnic areas on grounds.

Hours 8 A.M.-7 P.M., May-October. **Area** 125 acres, of which 25 are open to the public, 9 as formal gardens and the balance in a natural state. Staff of 4 (8). Rose and rock gardens. Evergreen garden, 40-50 years old, has fine specimens of white fir (*Abies concolor*), Scots pine (*Pinus sylvestris*), blue spruce, others. Nature trails. Arboretum of native Indiana trees.

Directions Gardens are 2 miles north of Wabash (and $\frac{1}{2}$ mile north of Rte. 24 Bypass). Follow directional signs from Rte. 15. Wabash is 45 miles west of Fort Wayne, 75 miles north of Indianapolis and 115 miles southeast of Chicago.

MICHIGAN

Ann Arbor. Matthaei Botanical Gardens University of Michigan, 1800 Dixboro Rd., Ann Arbor, Michigan 48105 (313-764-1184). Established 1960. Operated by Botany Dept. Adult evening courses. Guided tours for school groups. Educational exhibits in main building changed every two months. Book: Michigan Botanical Club *Mushroom Field Guide*, \$1.25 by mail.

Hours 9 A.M.-5 P.M. **Area** 300 acres (60 cultivated). Staff of 17. More than 3,000 kinds of plants. A major university botanic garden with attractively landscaped grounds. Rose and medicinal plant gardens. The outdoor fern collection of *Dryopteris* species and hybrids is thought to be the most extensive in the U.S.

Display conservatory has substantial collections of tropical plants and cacti. Some plant groups of special interest in the research greenhouses, open by request, are orchids, bromeliads and ferns.

Trails have been built to take advantage of the different habitats in the natural parts of the Gardens. Areas along the trails include pine plantation, lowland forest community, upland old hickory forest, flood plain, water habitat. One area has been planted to simulate a prairie.

Gardens have two subsidiary stations: **Radrick Bog and Forest**, $\frac{1}{3}$ mile south of the main building; **Horner Woods** (44 acres), 1 mile north of Gardens off of Ford Rd.

Directions Gardens are 5 miles north-east of campus via Plymouth Rd. They are on Dixboro Rd., between Plymouth and Geddes Rds. Gardens are about 30 miles west of Detroit.

Ann Arbor. Nichols Arboretum Geddes Ave., Ann Arbor, Michigan (mailing address: 975 Hill St., Ann Arbor 48104) (313-764-1817). Established 1907. Operated by University of Michigan.

Hours Dawn-dusk. **Area** 150 acres. Staff of 4. Arboretum, characterized by its beautiful topography and large natural areas, is used more as a community park

than it is for study purposes. Magnolias. Plants not labeled.

Directions Arboretum is on Geddes Ave., just east of the main campus of University of Michigan.

Detroit. Anna Scripps Whitcomb Conservatory Belle Isle Park, Detroit, Michigan 48207 (313-531-4108). Established 1904 (rebuilt 1955). Operated by Dept. of Parks and Recreation, City of Detroit (mailing address: Water Board Building, 735 Randolph St., Detroit 48226; tel. 313-962-6570). Conservatory brochure. Bulletins on thirty subjects. Picnic area, restaurant and recreational facilities in Park.

Hours 9 A.M.-7 P.M., summer; 9 A.M.-5 P.M., rest of year. Staff of 35. Six special flower shows: chrysanthemums; Christmas; winter; Easter; Mother's Day; summer. Call 313-567-3911, Ext. 19 for dates. There are permanent display green-

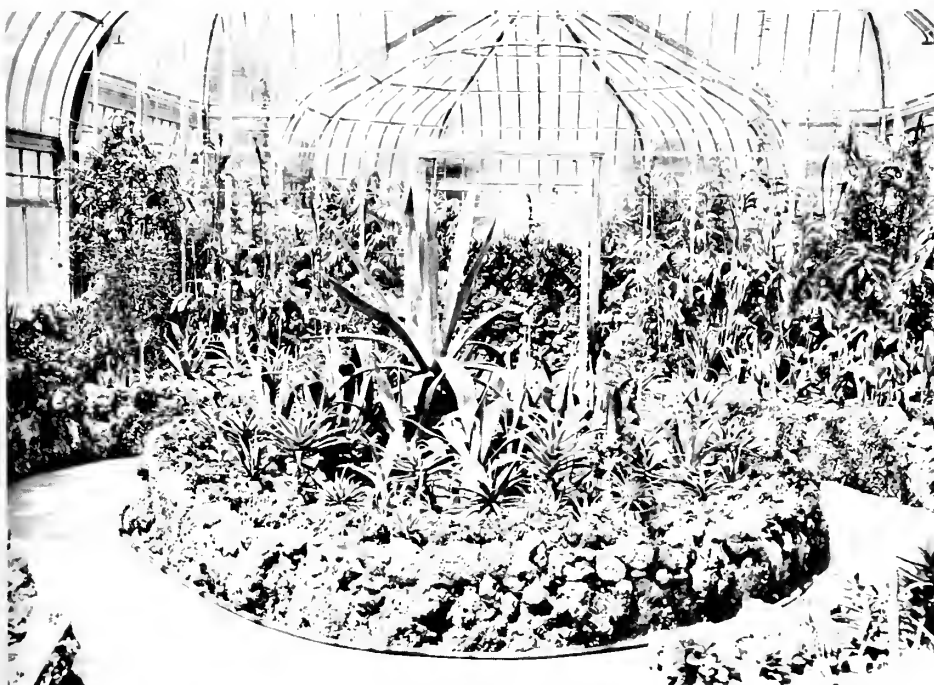
houses for ferns, cacti, palms, tropical plants and orchids. Orchids are best from mid-January to March.

Formal gardens outdoors, next to Conservatory. Dahlias, perennials. Water-lily pool. Aquarium is behind the show greenhouse.

Directions Conservatory is in Belle Isle Park, an island in the Detroit River. Belle Isle (MacArthur) Bridge is a continuation of E. Grand Blvd. Public transportation: E. Jefferson Ave bus to E. Grand Blvd., then Belle Isle bus.

East Lansing. Beal-Garfield Botanic Garden Michigan State University, East Lansing, Michigan 48823 (517-355-1855). Founded 1873. Guided tours by appointment. Brochure. Restaurant on campus.

Hours Dawn-dusk. **Area** 5 acres. Staff of 4. Over 5,000 kinds of plants. Collections arranged in four categories: *systematic*—family groupings according to



North wing of the Anna Scripps Whitcomb Conservatory, operated by City of Detroit.



View within Beal-Garfield Botanic Garden, Michigan State University.

botanical relationships; *economic*—of direct use to man (dye, fiber, food, medicinal and perfume plants, also injurious plants); *ecological*—Michigan plant communities; *landscape*—plants of ornamental value. Rhododendron and azalea collection.

Botanic Garden is just one small area of an attractively landscaped, 4,800-acre campus that has more than 7,000 species and varieties of woody plants. The less common trees and shrubs along the 60 miles of campus walks are labeled. Campus also includes **Horticultural Gardens**, where the emphasis is on display and testing.

East Lansing is 50 miles northwest of Ann Arbor (*see listing for Matthaei Botanical Gardens* of the University of Michigan), and 75 miles northwest of Detroit.

Also see Tipton listing for **Hidden Lake Gardens**, a subsidiary of Michigan State University, 55 miles southeast of E. Lansing.

Niles. Fernwood, Inc. 1720 Rangeland Rd., Niles, Michigan 49120 (616-695-6491). Established 1964. Privately owned

non-profit organization with part financial support from membership. Brochure. Children's and adult education programs. Guided tours by appointment.

Admission: 50 cents for non-members. A monthly bulletin, *Fernwood Notes*, is sent to members. Gift shop. Picnic area in nearby Buchanan.

Hours 9 A.M.-5 P.M. Tuesday-Sunday.

Area 90 acres. Fernwood is partly a nature center, with the emphasis on native trees, wildflowers and ferns. Bog garden. Wildflower trails (one marked).

The cultivated area at Fernwood has herb, perennial, rock, boxwood and lilac gardens. Labeling in process. A new arboretum is in the planting stage. Ideal time to visit is April 15-June 1.

Directions Fernwood is 8 miles north of Niles via Rte. 31. Accommodations in Niles or Buchanan. Gardens are about 18 miles north of South Bend, Indiana; 43 miles northeast of Michigan City, Ind. (*see listing*).

Tipton. Hidden Lake Gardens Rte. 50, Tipton, Michigan 49287 (313-431-2060). Begun privately in 1926 by H. A. Fee, who gave the land to Michigan State University in 1945. Developed and maintained by private endowment.

Admission: 50 cents per car (exact change needed to operate gate). Guided tours by appointment. Museum-type displays in Gardens Center building. Gift shop. Brochure free by mail, 10 cents at shop. Trail guide booklet. Picnic area.

Hours 8 A.M.-dusk weekdays, 9 A.M.-dusk weekends and holidays. **Area** 620 acres, of which 120 are devoted to an arboretum. Staff of 15. **Kinds of plants** 1,500.

The main arboretum plantings have occurred since 1960. Collections: crab-apple, flowering cherry, hawthorn, juniper, lilac, magnolia, maple, mountain-ash, ornamental evergreens. Dwarf shrub garden. Ideal times to visit are April 15-May 30, October.

All-America demonstration garden (annuals). Five miles of nature trails. Six-acre lake. Modern conservatory includes

tropical and arid "domes," temperate house.

Directions Gardens are 8 miles west of Tecumseh on Rte. 50. Accommodations in Tecumseh or Adrian. Gardens are 55 miles southwest of Ann Arbor and 55 miles southeast of E. Lansing. *See respective listings.*

MINNESOTA

Chaska. University of Minnesota Landscape Arboretum Rte. 1, Box 132-1, Chaska, Minnesota 55318 (612-443-2460). Established 1958. Operated by U. of Minn. and the Arboretum Foundation. Support from membership.

Admission: \$1 per car for non-members. Brochure. Conducted tours by appointment. Adult gardening classes. Spring plant sale. Maple syrup demonstrations. Picnic area on grounds. Book shop and restaurant planned.

Hours 8 A.M.-8 P.M. **Area** 525 acres (part woodland). **Staff** of 7. **Kinds of**

plants 3,000. A major university arboretum-in-the-making. Special areas devoted to ground covers, hedges, vines. Principal collections: crab-apple; lilac; azalea; peony; hosta and Clematis. Old roses. Hardiness trials.

Specimen trees: basswood (*Tilia americana*); sugar maple; white oak; burr oak (*Quercus macrocarpa*). Six miles of nature trails. Ideal times to visit are May-June, September-October.

Directions Arboretum is 25 miles west of Minneapolis via Rte. 5.

Minneapolis. Eloise Butler Wild Flower Garden Glenwood Pkwy., Minneapolis, Minnesota. Operated by Minn. Park Board (250 S. 4th St., Minneapolis 55415. 612-330-2121). Established 1907. Support from "Friends of the Wild Flower Garden." Guide for children's groups. Picnic area.

Hours 8 A.M.-6 P.M., April 1-Novem-



View of Hidden Lake, a focal point at Hidden Lake Gardens, Tipton, Michigan.

ber 10. **Area** 13 acres. **Kinds of plants** ca. 1,000. A woodland garden with marked trails. Bog, prairie. Native lady-slippers. Bird sanctuary. Best time to visit is from April 30-July 10.

Directions Garden is on Glenwood Pkwy. between Rte. 55 (Olsen Memorial Hwy.) and Rte. 12 (Wayzata Blvd.)

Also in Minneapolis: Greenhouse of the College of Pharmacy, University of Minnesota campus. Medicinal plants.

St. Paul. Como Park Conservatory 1224 N. Lexington Pkwy., St. Paul, Minnesota 55103 (612-489-1740). Founded 1915. Operated by St. Paul Dept. of Parks and Recreation. Guided tours for groups by appointment. Brochure has map showing major plants (unlabeled). Picnic area and snack bars in Como Park.

Hours 10 A.M.-5 P.M., in summer to 8 P.M. **Area** 3 acres. Staff of 8. **Kinds of plants** over 150. Tropical greenhouse with "Gates Ajar" floral display. Seasonal shows. Sunken gardens. Area near conservatory is being developed as a memorial garden.

Directions Como Park is 3 miles from the Capitol building via Como Ave. It is serviced by the "Como" bus.

OHIO

Berkey. (Toledo). Secor Park Arboretum R.R. 1, Berkey, Ohio 93504. Established 1959. Operated by Toledo Metropolitan Park District. Guided tours by appointment (call 419-248-5911, Ext. 401). Occasional workshops. Exhibits. Brochure. Small gift shop. Picnic areas in park.

Hours 8 A.M.-dusk. **Area** 500 acres. Staff of 10. Flowering trees and shrubs. Peak display second week of May. Six nature trails. Greenhouse (9 A.M.-5 P.M. weekdays, 11 A.M.-6 P.M. weekends and holidays.)

Directions Arboretum is 9 miles west of Toledo on Rte. 20. Toledo is 80 miles northwest of Mansfield, O., 45 miles south of Ann Arbor, Mich., and 38 miles southeast of Tipton, Mich. See listings.

Cincinnati. Krohn Conservatory Eden Park Dr., Cincinnati, Ohio (513-721-0851). Established 1902 (current building dates from 1933). Operated by Cincinnati Park Board (950 Eden Park Dr., Cincinnati 45202). Cacti, palm and fern booklets, 35 cents each by mail. Picnic area in park.

Hours 10 A.M.-5 P.M. (Sunday to 6 P.M.) **Area** 20,000 square ft. Staff of 6. **Kinds of plants** 700. Tropical forest; cactus house, display areas. Six seasonal shows. Tree ferns, palms, orchids. Hinkle Gardens, just south of conservatory, have peonies, iris, day-lilies. Magnolias.

Directions Conservatory is in Eden Park, 1 mile east of the downtown area via Gilbert Ave.

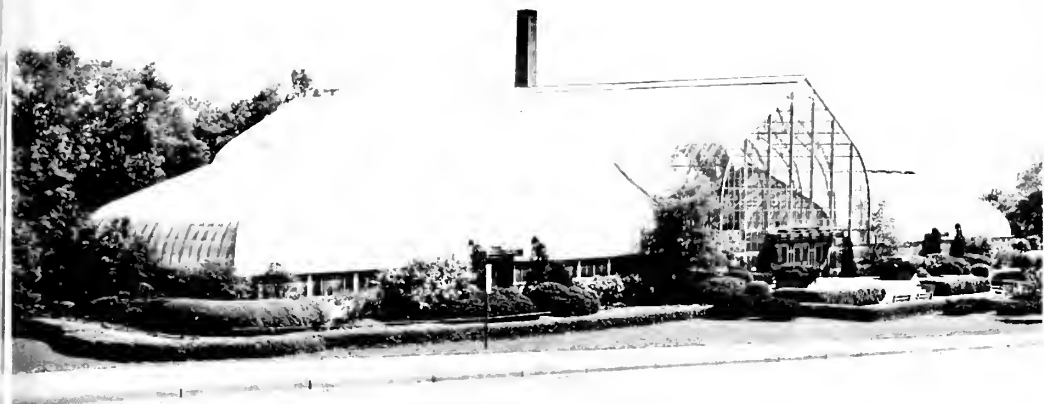
Cincinnati. Mt. Airy Arboretum 5083 Colerain Ave., Cincinnati, Ohio 45223 (513-541-8176). Founded 1933. Operated by Cincinnati Park Board. Guided tours in May for general public, other times for groups, with slide talk, by appointment. *Arboretum Guide* 25 cents, *Forest Guide* 5 cents. There is a picnic area in Mt. Airy Forest.

Hours 7:30 A.M.-dusk; closed holidays. **Area** 120 acres within 1,501-acre Mt. Airy Forest. Staff of 2 (5). **Kinds of plants** 1,800. Special areas: perennial azalea and green gardens. "Garden of the States" has the official tree or flower of each state.

Main collections: rhododendron, lilac and flowering quince. Sizable specimens of oak, maple and beech. A variegated beech (*Fagus sylvatica* 'Tricolor') is unusually large for this cultivar. Some trees labeled. Nature trails. Mid-May to mid-June is the ideal time to visit.

Subsidiary garden: **Hauck Botanical Garden** at Taft and Reading Rds. Mt. Airy Forest is itself of some interest as the first municipal reforestation project in the U.S. (1911).

Directions Mt. Airy Arboretum is in northwestern Cincinnati. Take Interstate Hwy. 75 to Colerain Ave. exit, then go north 2 miles on Colerain to Arboretum. Public transportation: Mt. Airy Line bus



Krohn Conservatory in Eden Park which is operated by the Cincinnati Park Board.

Cincinnati. Stanley M. Rowe Arboretum 4500 Muchmore Rd., Cincinnati, Ohio 45243. Started 1929. Private estate, actually a hobby garden that has reached arboretum dimensions. Picnic area on grounds.

Hours Dawn-dusk. **Area** 164 acres. Permanent staff of 5. **Kinds of plants** over 1,900. Special gardens: dwarf evergreen, wildflower. Principal collections: crab-apple (150 cultivars); pine. Also magnolia; dogwood; viburnum; juniper; hemlock; other conifers.

Specimen trees: Himalayan pine (*Pinus wallichiana* or *griffithii*), weeping white pine (*P. strobus* 'Pendula'). One oddity is a white pine variant with up to 10 needles to a cluster.

Directions Arboretum is in village of Indian Hill, 12 miles east of Cincinnati. Take Rte. 50 east to Mariemount, then go north 1½ miles on Miami Ave. to Muchmore Rd. East on Muchmore Rd. to Arboretum.

Cincinnati. Cemetery of Spring Grove 4521 Spring Grove Ave., Cincinnati, Ohio 45232 (513-681-6680). Established 1845. Guided tours and lectures for groups by appointment. Picnic area and shelter house on grounds. Restaurant nearby.

Hours 8 A.M.-5 P.M. **Area** 733 acres (400 developed). Total staff of 75. **Kinds of plants** 400. A cemetery with the same horticultural tradition as Mt. Auburn in Boston and Green-Wood in Brooklyn. They were part of an extensive 19th-century cemetery beautification movement, one that has largely been forgotten today. The movement was responsible for many fine specimen trees that are unrivaled in the major institutional arboreta, which all date from a more recent era.

Apart from old specimens of bald-cypress, American and European beeches, and white and burr oaks, Spring Grove has many trees and shrubs not normally seen in the Cincinnati area. Collection partly labeled. (Continued)



The bald-cypress swamp at The Dawes Arboretum in Newark, Ohio, is thought to be the most northerly such swamp in the U.S.

Rose garden, American holly collection. English ivy (*Hedera*) cultivars. Spring bulbs, summer bedding plants. Peak display in April-May, October.

Directions Cemetery is in the northern part of Cincinnati. Take Interstate Rte. 75 to Spring Grove Ave. exit and follow Spring Grove Ave. to Winton Rd., where the main entrance is located. Public transportation: No. 16 bus, also No. 71 at rush hour.

Cleveland. The Garden Center of Greater Cleveland and Western Reserve Herb Garden 11030 East Blvd., Cleveland, Ohio 44106 (216-721-1600). Garden Center founded 1930 as a non-profit, privately endowed organization. Support from membership and biennial "white elephant" sales.

The Garden Center has 2,800 members and 90 local garden clubs are affiliated. It has 9 officers and a permanent staff of 7. Educational program. Monthly periodical to members: *Garden Center Bulletin*.

Seasonal shows, exhibits. Extensive library has old herbals as well as current garden books. Gift shop open Tuesdays, Thursdays 11 A.M.-4 P.M. Picnic area on terrace.

Western Reserve Herb Garden, on the grounds of the Garden Center, is maintained by Western Reserve Society members. Completed 1969. Based on monastery and castle-keep gardens, it contains a central knot garden; dye plants; fragrant herbs; historical roses; culinary and medicinal plant sections. One of the country's

outstanding herb gardens.

Hours Garden Center is open Monday-Friday 9 A.M.-5 P.M., Sunday 2 P.M.-5 P.M. Closed Saturday.

Garden Center is in Wade Park in the University Circle section of Cleveland. It may be reached by bus No. 6 from Public Square to Mayfield Rd.

Columbus. Park of Roses High St. and Hollenback Dr., Columbus, Ohio. Operated by City of Columbus, Division of Parks and Forestry. Headquarters of The American Rose Society is adjacent to Park at 4048 Roselea Pl., Columbus 43214 (tel. 614-263-5160).

Admission: adults 25 cents, children under twelve 10 cents. Lectures; planting pruning and spraying demonstrations. Brochures. Pamphlet on selecting roses 10 cents. Guided tours for groups by reservation. Garden illuminated at night. Picnic area.

Hours 10 A.M.-dusk, May 30-October 15. **Area** 13½ acres of roses (5½ additional acres have perennials, crab-apples). There are 35,000 rose bushes. American Rose Society also has a test plot here for new cultivars.

Directions Park of Roses is in Whetstone Park, 5½ miles north of downtown Columbus. Take Freeway to N. High St. exit and follow signs to Park from 4000 block of N. High.

Also in Columbus: Franklin Park Conservatory (established 1895), 2½ mile east of center by Rtes. 40, 62. Conservatory is in the 1600 block of E. Broad St. Hours: 9 A.M.-3 P.M.

Dayton. Cox Arboretum 6733 Springboro Pike (Rte. 741), Dayton, Ohio 45449 (513-434-9005). Established 1962. Privately endowed, non-profit foundation. Membership support. Tours for school groups. Spring plant sale. Brochure. Picnic areas in nearby parks.

Hours Dawn-dusk. **Area** 164 acres. Staff of 2 (10). An arboretum-in-the-making, most plantings dating from 1967. A crab-apple collection is in formation. Lath house display. Small greenhouse. Current projects: synoptic shrub garden, visitors' center.

Directions Arboretum is 9 miles south of Dayton on Rte. 741. Best route from Dayton: Interstate 75 to Centerville-Miamisburg exit.

Mansfield. Kingwood Center Box 1186, 900 Park Ave. West (Rte. 430), Mansfield, Ohio 44903 (419-522-0211). Former estate of C. K. King, opened to public in 1953. Privately endowed; operated by Administrative Board. Children's and adult instruction programs. Lending library.

Guided tours for groups by appointment. Seasonal displays, exhibits and programs. Brochures. Restaurants nearby.

Hours 8 A.M.-dusk for gardens and greenhouses. French Provincial house and exhibit hall open April-November, 8 A.M.-5 P.M. Tuesday-Saturday; 1:30 P.M.-4:30 P.M. Sunday. **Area** 47 acres. Staff of 27. **Kinds of plants** 6,000.

Very attractively landscaped garden with extensive floral displays. Naturalized daffodils. Large tulip display, peonies (400 cultivars), lilies, day-lilies (400 cultivars), dahlias, roses. Annuals and perennials. American Iris Society test garden has 1,000 cultivars. Ornamental tree collection. Evergreens. Nature trails. Kingwood is a garden of season-round interest.

Although the greenhouses are small, they contain unusually good displays. When at their best, they are among the finest that can be seen in the Great Lakes region. Columneas, chrysanthemums. Hanging baskets.

Directions Kingwood Center is 1½

miles west of Mansfield on Rte. 430. Garden is about 68 miles southwest of Cleveland and 55 miles northeast of Columbus.

Mentor. Holden Arboretum Sperry Rd., Mentor, Ohio 44060 (216-946-4400). Founded 1932. Non-profit corporation with support from membership. Admission: 75 cents for non-members. Adult instruction courses, including teacher-training. Study programs in ecology, conservation, natural history.

Brochure. Trail guides and maps. Quarterly publication: *Leaves*. Gift shop. Picnic area. Restaurant nearby.

Hours 10 A.M.-7 P.M. May-October; 10 A.M.-4 P.M. rest of year. Closed Mondays. **Area** 2,200 acres (part field and woodland). Staff of 13. **Kinds of plants** over 5,000 (200 genera). Arboretum serves the dual purpose of a nature center and a study area for ornamental plants.

Of special interest in the cultivated plant collection: nut trees; ornamental fruit trees; conifers; horse-chestnuts; maples; lilacs; hollies. Wildflower garden; nature trails; wildlife preserve.

A subsidiary station, **Stebbins Gulch**, traces geological history over 100 million years. Subarctic plant life, left by retreating glaciers, still flourishes in its deep gorges.

Directions Arboretum is 20 miles east of Cleveland. Take Interstate 90 to Rte. 306, then south to Kirtland-Chardon Rd., whence to Sperry Rd., then left. Arboretum is 5 miles south of interchange of Rtes. 90, 306.

Newark. The Dawes Arboretum R.F.D. 5, Rte. 13, Newark, Ohio 42055 (614-345-2355). Founded 1929. Privately endowed. Children's gardens. Nature training programs for teachers, grade-school youth. Nature walks. Guided tours for groups by appointment. Maple syrup demonstrations, other activities. Brochure. Monthly newsletter. Picnic area.

Hours Dawn-dusk. **Area** 850 acres (325 developed). Permanent staff of 11. **Kinds of plants** 2,000. A woodland arboretum in part, containing what is



Mt. Airy Arboretum Center, Mt. Airy Forest, is operated by Cincinnati Park Board

thought to be the northernmost bald-cypress (*Taxodium distichum*) swamp in the U.S. Ohio's largest white pine tree (*Pinus strobus*) grows here. Many fine old beech, oak and maple trees. Forestry plantation.

In addition to a Japanese garden, the cultivated areas have collections of crab-apple; American holly (*Ilex opaca*); rhododendron and azalea; hawthorn. Small tropical greenhouse (8:30 A.M.-5 P.M. weekdays).

Directions Dawes Arboretum is 7 miles south of Newark, Ohio on Rte. 13. It is also 3 miles north of Interstate 70. Newark is 32 miles east of Columbus.

Strongsville. Gardenview Horticultural Park 16711 Pearl Rd. (Rte. 42), Strongsville, Ohio 44136 (216-238-6653). Begun in 1949 by H. A. Ross, who continues to be responsible for the garden. A non-profit corporation supported mainly by membership. Admission: adults 75 cents,

children 25 cents. Brochure available (send self-addressed envelope with two stamps).

Hours Dawn-dusk, weekends. Other times by appointment. **Area** 16 acres. Staff of 1. Many cultivars of flowering crab-apple. Spring, annual and perennial gardens; also water gardens (ponds). Uncommon plants. Collections partly labeled. Ideal time to visit is the first two weeks of May.

Directions Park is 17 miles from downtown Cleveland. Rte. 42 from Cleveland becomes Pearl Rd. in Strongsville.

Wooster. Secrest Arboretum Ohio Agricultural Research and Development Center, Wooster, Ohio 44691 (216-264-0121). Established 1908. Guided tours by appointment. Brochure. Restaurant nearby.

Hours Open continuously. **Area** 12 acres. Staff of 3. **Kinds of plants** 1,500. Primarily a research facility, but of interest to the home gardener for its rhodo-



The Eleanor Squire Library at The Garden Center of Greater Cleveland in Ohio.

dendron and holly display gardens. Shade tree evaluation plot.

Special collections: yew (*Taxus*) (100 cultivars), crab-apple (135 cultivars), fir, spruce, juniper. An old-fashioned rose garden is adjacent to the arboretum.

Directions Arboretum is 2 miles south of Wooster via Rte. 250. Wooster is 50 miles south of Cleveland and 30 miles east of Mansfield.

2,389-acre park. Staff of 4. Main collection: modern and old-fashioned roses. Tulips, annuals, chrysanthemums.

Directions Gardens are in a hilly section overlooking the city from the southwest. They are at the north end of Mill Creek Park near Mahoning Ave. (Rte. 18) and Glenwood Ave. Youngstown is 60 miles southeast of Cleveland.

WISCONSIN

Youngstown. Fellows Riverside Gardens Mill Creek Park, 816 Glenwood Ave., Youngstown, Ohio 44502. Established in 1963 through a bequest of Elizabeth A. Fellows. Operated by Youngstown Township Park District (216-343-7219), which also prints an information sheet on the Park.

Adjacent **Garden Center** is operated by the Garden Forum of Greater Youngstown. Picnic area in surrounding Park. Restaurants nearby.

Hours Dawn-dusk. **Area** 15 acres of

Hales Corners (Milwaukee). Boerner Botanical Gardens, Rte. 100, Hales Corners, Wisconsin 53130 (414-425-1130). Established 1939. Operated by Milwaukee County Park Commission. Guided tours and lectures for groups of 25 or more by appointment. Public lecture series (calendar on request). Illustrated brochure \$1.25 by mail. Nature and trail-hiking guide booklets, cultural bulletins. Book-gift shop. Picnic areas in surrounding Whitnall Park. Restaurant in conjunction with golf course.



The rose garden in the Boerner Botanical Gardens in Hales Corners near Milwaukee.

Hours 8 A.M.—dusk. **Area** 500 acres. Staff of 55 (75). **Kinds of plants** 11,000—13,000. A major garden with many special gardens: rose; day-lily; rock; annual; peony; perennial test; bog and prairie. Tulip-lilac garden. Herb garden has one of the largest collections of its kind in the country. Shrub mall. Water-lily pools. Extensive mulch exhibit. Lawn grass demonstration plots.

Principal collections: crab-apple; conifer; street tree (demonstration plots); dwarf fruit tree; dahlia; chrysanthemum. Conifer trail. Wildflowers, nature trails.

Botanical Gardens have the largest sugar maple in Wisconsin; also the largest black walnut; a 200-year-old white ash.

Directions Garden is 2 miles southwest of the city limits of Milwaukee, with main entrance on Rte. 100, just south of the intersection with Rte. 24. Public transportation: No. 64 bus to park entrance at Scharles Ave. and Forest Home Ave. Walk east $\frac{3}{4}$ mile to Garden.

Madison. University of Wisconsin Arboretum 1207 Seminole Highway, Mad-

ison, Wisconsin 53711 (608-262-1234). Established 1934. Operated by University with some support from membership. Descriptive map 25 cents. Picnic area at nearby Vilas Park.

Hours 8 A.M.—10 P.M. **Area** 1,200 acres (including 40 acres in Longenecker Horticultural Gardens section). Staff of 13. **Kinds of plants** about 1,750. Primarily a research and teaching arboretum but with tree and shrub display gardens.

Collections of interest: lilac, crab-apple, viburnum. Natural plant associations, e.g. prairie, oak-hickory forest. Nature trail.

Early May is the best time to visit for wildflowers and crab-apples; mid-May for lilacs; summer for plants of the prairie.

Directions Arboretum can be reached by taking Monroe St. to Nakoma Rd. then Nakoma Rd. to Seminole Hwy. It is about 2 miles from campus.

Milwaukee. Mitchell Park Horticultural Conservatory 524 S. Layton Blvd., Milwaukee, Wisconsin 53215 (414-645-6063). First conservatory built 1898, razed in 1956. Strikingly modern geodesic dom



Paul Briol

Daffodils naturalized in the grass at the Cemetery of Spring Grove, Cincinnati, Ohio.



Milwaukee County Park Commission

Dome-shaped buildings comprise the Mitchell Park Horticultural Conservatory.

conservatories opened in 1964. Operated by Milwaukee County Park Commission (901 N. 9th St., Milwaukee 53233; call 414-276-1658 for Park information).

Admission: 25 cents after 11 A.M.; under 16 free. Guided tours and lectures for groups by arrangement. Various brochures, including dates for seasonal shows. Conservatory booklet \$1. Plant culture brochures. Gift shop, including books and plants. Picnic area and refreshment stand (summer) in Park.

Hours 9 A.M.-9 P.M. (Monday, 9 A.M.-5 P.M.) **Area** 2½ acres under glass in 60-acre park. Staff of 19. Tropical Dome arranged geographically (e.g., Amazon rain forest with lagoon, Australian section). Arid Dome has cacti and other succulents, some over 100 years old. Show Dome has permanent background plantings, seasonal shows (Easter; Mother's Day; Summer; Christmas; Winter; Fall).

Surrounding Park contains sunken gardens built in 1907. Rose and perennial malls. Recreational facilities.

Conservatory is at S. Layton Blvd. and W. Pierce St. It can be reached by No. 27 (27th St.) bus or by No. 18 (National Ave.) bus.

See also Hales Corners, Wis. (Boerner Botanical Gardens).

Oshkosh. Paine Art Center and Arboretum 1410 Algoma Blvd., Box 1097, Oshkosh, Wisconsin 54901 (414-235-4530).

Privately endowed. Tudor manor house built as residence in 1920's. Art center founded 1948. Art museum in house. Guided tours for groups by reservation (in writing, at least 2 weeks in advance). Book shop. Picnic area in nearby park.

Hours 9 A.M.-5 P.M. daily except Mondays, June 1-August 1, rest of year, building 2 P.M.-5 P.M., grounds 9 A.M.-5 P.M. Closed Monday, Wednesday and Friday August through May.

Area 25 acres. Staff of 12. **Kinds of plants** 200. English flower garden, wild-flower trail. Ornamental trees and shrubs. Specimen trees include an aged burr oak (*Quercus macrocarpa*), ginkgo.

Directions The Art Center and Arboretum is at the junction of Rtes. 21, 110 in Oshkosh. Oshkosh is 75 miles northwest of Milwaukee.

Somers. Hyslop Foundation Hawthorn Hollow, Somers, Wisconsin (mailing address: 5820 - 3rd Ave., Kenosha, Wisconsin 53140). Opened to the public 1971. A privately operated and endowed arboretum-in-the-making. Public solicitation anticipated.

Hours Daylight. Nature trails. Arboretum is in the process of collecting, identifying and planting trees and shrubs as well as herbaceous plants.

Directions Hawthorn Hollow is adjacent to Petrifying Springs Park, 6 miles northwest of Kenosha.

MIDWEST, SOUTHWEST & WEST

COLORADO

Denver. Denver Botanic Gardens 909 York St., Denver, Colorado 80206 (303-297-2547). Established 1956. Operated by Denver Park and Recreation Dept. Support from membership. Brochure. Monthly newsletter. Quarterly publication: *Greenthumb*. Guided tours.

Garden has a recently completed education building. Adult instruction program. Children's garden. Gift and book shops. Plant sales. Picnic grounds in adjacent park.

Hours 9 A.M.-5 P.M. weekdays, 10 A.M.-5 P.M. weekends. Boettcher Conservatory open at these hours, also 7 P.M.-9 P.M. Fridays. **Area** 20 acres in Denver, 150 acres at Mount Goliath. Staff of 20. **Kinds of plants** 2,500. Major part of the outdoor area at Denver is currently under construction. A Japanese garden is being planned within the larger framework.

Special gardens: herb, native plants. Water displays. Annuals. Collections: tropical plants and tender cacti in conservatory; junipers and other conifers;

Garden also operates the Walter Pesian Trail on Mount Goliath, 50 miles west of Denver via Rte. 40. It is open June through August.

Directions Botanic Gardens are about 10 minutes east of downtown Denver via Colfax Ave. Turn right on York St. and go 4 blocks to entrance.

IOWA

Ames. Iowa Arboretum c/o Dept. of Horticulture, Iowa State University, Ames, Iowa 50010 (515-294-4111). Established 1968. Operated by Iowa Arboretum, Inc., with support from membership. Brochure.

Hours Open continuously. **Area** 340 acres (80% woodland). Arboretum is in

an initial stage of development. Areas will be cultivated as funds become available.

Directions The arboretum site, near the town of Luther, is about 35 miles northwest of Des Moines. It is adjacent to the Iowa 4-H Camp.

Clinton. Bickelhaupt Arboretum 340 S. 14th St., Clinton, Iowa 52732. Established 1970. Privately owned. Guided tours for groups by appointment.

Hours Dawn-dusk. **Area** 10½ acres. Staff of 3. Arboretum is in an early stage of development. Young specimen trees: metasequoia, ginkgo, globe locust (*Robinia pseudoacacia* 'Umbraculifera').

Des Moines. den Boer Arboretum of Flowering Crabapples Des Moines Water Works Park, 1003 Locust St., Des Moines, Iowa 50307 (515-288-2281). Established in early 1920's. Owned by City of Des Moines, but managed by Board of Water Works Trustees. Guided tours for school groups. Brochure. Plant collection lists. Picnic area. Restaurant nearby.

Hours Dawn-dusk; greenhouse 7:30 A.M.-4 P.M. weekdays, also weekends in good weather. **Area** 20 acres in a 1,500-acre park. Gardening staff of 4. **Kinds of plants** over 215 species and cultivars of crab-apple. Total crab-apple trees: about 2,000. Usual flowering time: May 1-10; fruits, August to winter.

The name of the Arboretum honors the late Arie den Boer, who compiled the collection here. He is author of a definitive book, *Flowering Crabapples*.

Just north of the greenhouse is a rare plant section, which also demonstrates unusual treatments of plants. In addition to crab-apples, Arboretum has a small rare-tree collection. The principal herbaceous collection is hosta (180 kinds, many imported from Asia and the Netherlands). Greenhouse: cacti and other succulents.

Directions Arboretum entrance is on Fleur Dr., in heart of Des Moines, 2 blocks from the Loop. Fleur Dr. is the main road from the Airport to downtown Des Moines.



Road through den Boer Arboretum of Flowering Crabapples, Des Moines Water Works Park in Iowa.

KANSAS

Manhattan. **Kansas Landscape Arboretum** c/o Kansas State Horticultural Society, Kansas State University, Manhattan, Kansas 66502 (913-532-6011). Established 1970. Land donated by U.S. Army Corps of Engineers to Horticultural Society (membership organization). Promotional brochure on request. Picnic area. Restaurant 3 miles away in Wakefield.

A new arboretum, mostly in the planning stage, on 193 acres of farm and woodland. Twenty-five existing native tree species. Prairie wildflowers, grass preserve. Plans for nature trails, bird sanctuary, trail for the blind.

Directions Arboretum is on the western shore of Milford Lake. Take Rte. 82 west from Milford, then go south on Rte. S37 to entrance. Manhattan is 50 miles west of Topeka.

Topeka. **Meade Park Gardens** 121 N. Fillmore Gardens, Topeka, Kansas 66606 (913-235-0806). Established 1963. Operated by Topeka Park Dept. Partial support from Meade Park Garden Center Assn. Brochure. Guided tours by appointment. Various programs sponsored by Topeka garden clubs. Picnic area next to Gardens.

Hours 6 A.M.-10 P.M. Garden Center open 1 P.M.-4 P.M. weekdays. **Area** 5 acres. **Staff** of 4. **Kinds of plants** 400. Garden is collecting lesser known woody plants, especially trees that grow no taller than 30 ft. Peak display in April and first two weeks of May.

Directions Gardens are 1 block south of Interstate 70. Public transportation: Kenwood bus to Fillmore St., then walk 3 blocks north.

Also operated by the Park Dept.: **Gage Park Greenhouse** 4320 W. 10th St. (8 A.M.-4 P.M. weekdays, 1:00-4:00 P.M. Sundays).

MISSOURI

St. Louis. **Missouri Botanical Garden** 2315 Tower Grove Ave., St. Louis, Missouri 63110 (314-865-0440). Established 1859 ("Shaw's Garden"). Privately endowed, supported in part by "Friends of the Garden" and the Arts and Education Council.

Admission: adults 50 cents, under 18 25 cents, under 5 free. Brochure, tree-trail map free at entrance. Pictorial Guide Book \$1.25. Publication: *Missouri Botanical Garden Bulletin* (bi-monthly). Gift and book shops. Snack bar. Picnic area to south in Tower Grove Park.

Guided tours for groups by reservation. Gardening courses for adults. Children's nature study classes. Special outdoor events. Annual plant sale.

Hours 9 A.M.-6 P.M. weekdays (to 7 P.M. weekends and holidays) from May 1 through October; 9 A.M.-5 P.M. weekdays (to 7 P.M. weekends and holidays) rest of year. Closed January 1, December 25. **Area** 75 acres. Staff of 100. **Kinds of plants** over 5,000.

A garden of some historical note, founded by Henry Shaw, who made a fortune in the hardware business and retired at age 40 to pursue a botanical avocation in a day when St. Louis wasn't much more than a frontier town. Noted botanist George Engelmann made the garden his headquarters for many years.

Apart from its research activities, the Garden is perhaps best known today for the Climatron, a greenhouse conservatory of revolutionary design. The ½-acre structure was built to accommodate in one room plants with different heat and humidity requirements. Four basic "climate zones" exist, based on hot air blowers and a cooling system.

There are two rose gardens, an herb garden and water-lily pools. Old specimen trees: copper beech (*Fagus sylvatica* 'Atropunicea'); bald-cypress (*Taxodium distichum*); Osage-orange (*Maclura pomifera*); ginkgo (*Ginkgo biloba*).

Indoor collections: aroid, orchid, cacti and other succulents. Tropical plants. Linnaean House has camellias.

Outreach station: **Missouri Botanical Garden Arboretum** Gray Summit, Mo. 63039. Ozarkian flora, daffodils, native trees. Entrance is at the junction of Interstate 44 and Rte. 100, about 35 miles southwest of St. Louis.

Directions Missouri Botanical Garden is in the middle of St. Louis. It is serviced by Sarah Bus No. 42.

OKLAHOMA

Oklahoma City. Will Rogers Horticulture Garden 3500 Northwest 36th St., Oklahoma City 73112 (405-943-3977). Founded 1938. Operated by City Park



View in Meade Park Gardens, Topeka.

and Recreation Dept. Tour sheet of garden on request. Monthly garden lectures, October-May. Rose pruning demonstrations. Picnic area adjacent. Restaurant within ½ mile.

Hours 8 A.M.-dusk. Greenhouse same hours. **Area** 30 acres. Staff of 8. **Kinds of plants** over 100. Gardens: rose, iris, "memory" (old-time plants). Azalea trail. Junipers, holly, redbud, crape-myrtle, hibiscus, old-fashioned roses. Cacti and other succulents. Peak display: late April-May.

Directions Garden is 36 blocks north of the center of town. Public transportation: No. 8 bus to 36th & May.

Also in Oklahoma: Tulsa Garden Center 2435 S. Peoria Ave., Tulsa. Greenhouse, chrysanthemum test garden. Rose garden adjacent.

ARIZONA

Phoenix. Desert Botanical Garden 6400 E. McDowell Rd., Box 5415, Phoenix, Arizona 85010 (602-947-2800). Established 1938 by Arizona Cactus and Native Flora Society. Privately endowed, with support from membership.

Admission: adults 50 cents, students 25 cents, children 10 cents. Adult instruction courses, lectures, monthly nature trips to desert. Guided tours by appointment. Brochure 10 cents. Publication: *Saguaro-land Bulletin* (ten times yearly). Plant



Linnaean House at the Missouri Botanical Garden is the oldest greenhouse west of the Mississippi. It houses camellias.

sale during cactus show in late February. Gift shop. Picnic area and restaurant nearby.

Hours 9 A.M.-5 P.M. **Area** 120 acres. Staff of 9. **Kinds of plants** 4,230. Collections: cactus, agave, dry-climate trees and shrubs. Specimen trees: Australian acacias and cassias. Lath house displays of cacti and other succulents. Trails. Peak flowering occurs in April, but the nature of the garden makes it of year-round interest to northern gardeners.

Directions Garden is in Papago Park in the eastern city limits of Phoenix. Public transportation: Valley bus to Tempe; also Phoenix No. 3.

Tucson. Arizona-Sonora Desert Museum Box 5607, Tucson, Arizona 85703 (602-792-1530). Founded 1952. Non-profit corporation administered by Board of Trustees. Admission: adults \$1.50, ages 13-15 \$1, ages 6-12 25 cents. Additional support from local garden clubs. Folder on request; color guide book \$1.25 by mail. Museum displays of natural history of Arizona with living plants and animals. Restaurant on premises. Picnic areas near.

Hours 9 A.M.-dusk. **Area** 12 acres. Staff of 4. **Kinds of plants** 300. Demonstration Desert Garden for home landscaping; Haag Memorial Cactus Garden. The emphasis is on plants that are native to Arizona, especially those of the Sonoran Desert. Peak display: April-May.

Directions Desert Museum is 14 miles

west of Tucson via Speedway or Ajo Way (Rte. 86). Follow Museum signs. Public transportation: Gray Line Tours from Tucson.

Also in Arizona. **Boyce Thompson Southwestern Arboretum** 3 miles west of Superior via Rtes. 60, 70. Established in 1924, it is now operated as part of the Desert Biology Station of University of Arizona. Dry-climate trees and shrubs, native flora. Arboretum is about 55 miles east of Phoenix.

TEXAS

Dallas. Dallas Garden Center Forest & 1st St., State Fair Grounds, Box 26194, Dallas, Texas 75226 (214-428-7446). Operated by City Park and Recreation Dept., with support from membership and donations. Landscape and flower arranging classes. Garden books, post cards for sale. Picnic facilities and restaurant nearby.

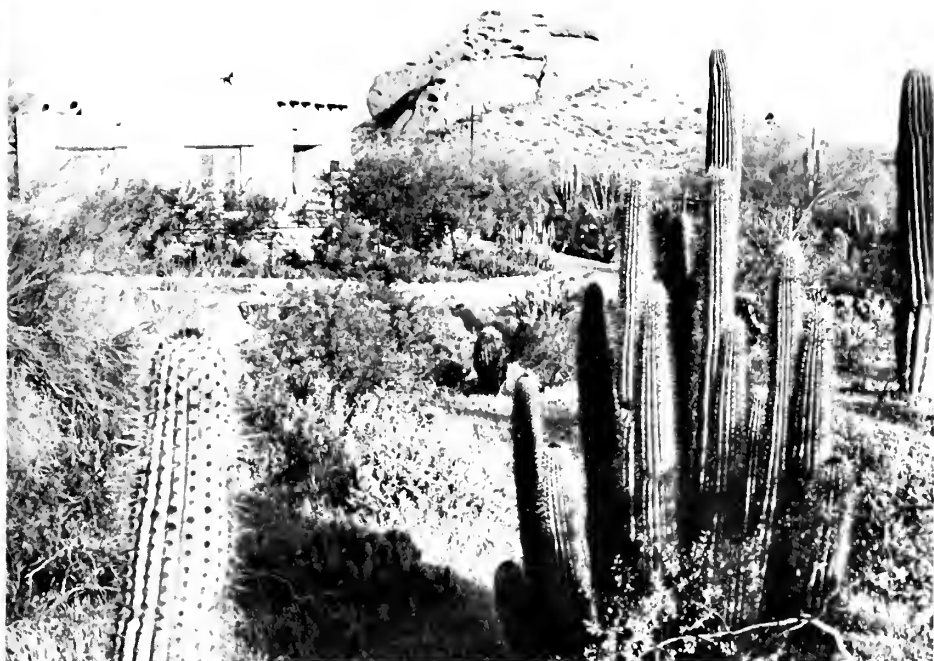
Hours 10 A.M.-5 P.M. weekdays, 2 P.M.-5 P.M. weekends and holidays. Closed Christmas. **Area** 7½ acres. Staff of 6. Gardens in the larger framework: herb, water, rose, day-lily, Shakespeare, iris. A large garden room houses tropical plants. Bromeliads. Garden Center plans to expand in the 1970's.

Directions The State Fair Grounds are 2 miles east of Dallas via Rtes. 67, 80.

Fort Worth. Fort Worth Botanic Garden 3220 Botanic Garden Dr., Fort Worth, Texas 76107 (817-737-3330). Established 1935. Operated by Fort Worth Park Board. Guided tours for groups by appointment. Garden club programs. Brochure. Sales counter. Picnic area in adjacent park. Restaurant nearby.

Hours Open continuously (Garden Center: 8 A.M.-4 P.M.). **Area** 90 acres Staff of 13. **Kinds of plants** 2,000 Seented garden for the blind. Iris garden. Six-acre Japanese garden under construction. Crape-myrtle, holly.

Garden has old pecan trees (*Carya ilinoensis*) and burr oaks (*Quercus macrocarpa*). Much of the site is in a natural



W. H. Earle

Herbarium (Barne's Butte in background) of Desert Botanical Garden in Phoenix.

state. No plants are labeled.

Greenhouses (7:30 A.M.—4 P.M. Monday-Friday, Sunday 2 P.M.—4 P.M.): orchids, ferns, house plants.

Directions The Garden, which is unfenced, is next to Trinity Park. Take East-West Freeway westbound to University Dr. Exit, then go north to Botanic Garden Dr.

Houston. **Houston Arboretum and Botanical Garden** Box 55647, Voss Rd. & Memorial Dr., Memorial Park, Houston, Texas 77055. The core of the Garden is **Aline McAshan Botanical Hall** for Children (established 1968), (713-681-8433), operated by the Houston Botanical Society, a membership organization. The surrounding Arboretum is a woodland under the jurisdiction of Houston Parks and Recreation Dept.

Youth instruction, partly in conjunction with Houston schools. Children's greenhouse. School-age and adult lectures, nature programs. Adult instruction program. Diarama. Garden map, trail guide 10 cents, available only at door. Picnic area in adjacent part of park.

Hours 8 A.M.—6 P.M. (Botanical Hall open 8:30 A.M.—5:30 P.M. Monday-Saturday; 1 P.M.—5:30 P.M. Sunday). **Area** 265 acres of woodland in Memorial Park. Staff of 7. **Kinds of plants** over 235 (woody). Herb and holly gardens near building.

Arboretum is largely a mixed deciduous forest. Native trees: river birch (*Betula nigra*); water oak (*Quercus nigra*); cottonwood (*Populus deltoides*); bald-cypress (*Taxodium distichum*). Wildflowers. Trails.

Also in Houston: **Garden Center in Hermann Park.** Roses. Fragrance garden. Herb-perennial garden.



View within the cactus garden of the Arizona-Sonora Desert Museum, near Tucson.

UTAH

McAllen. Valley Botanical Garden Rte. 83, Box 1394, McAllen, Texas 78501. Established 1960. Operated jointly by municipal and private sources, with support from membership. The purpose of the Garden is to provide work for people of the Rio Grande Valley who are mentally retarded or physically handicapped. Education program for the handicapped.

Hours 8 A.M.-dusk. **Area** 20 acres. Staff of 5. Special gardens: herb, rose, sunken. Norman Heard specimen trees arboretum. State map of bluebonnets; bougainvillea lane; citrus arboretum. Palms, poinsettia, cactus. Peak flowering: December-January; March-April. Nature trail. Picnic area.

Editors Note: The Menninger Foundation, Topeka, Kansas operates an arboretum as a therapeutic aid for patients with emotional problems. Not open to the public. See article in Winter 1967-68 PLANTS & GARDENS (Vol. 23, No. 4).

Also in Texas: Tyler Rose Park. W. Front & Boone Sts., Tyler; Chandor Gardens W. Simmons St., Weatherford (fee). Texas A. & M. University Arboretum & Trial Grounds, College Station.

Salt Lake City. State Arboretum of Utah University of Utah, Salt Lake City, Utah 84112 (801-322-6711). Established 1961 (many plantings of an earlier date). Part support from Arboretum Society (membership). Adult classes, lectures. Guided tours by appointment. Brochure for self-guiding walking tour of Arboretum. Restaurant on campus. Picnic area in Liberty Park, 1 mile away.

Hours Dawn-dusk. **Area** 630 acres. Staff of 22. **Kinds of woody plants** 440. Arboretum is the University campus. There is a rose garden west of Orson Spencer Hall and an herb garden in Chapel Glen. A display garden is planned.

Special collections: hybrid oaks; native conifers; *Opuntia*. Specimen trees: *Cedrela sinensis*; silk-tree (*Albizia julibrissin*); Crimean linden (*Tilia euchlora*); Kentucky coffee-tree; giant-sequoia; others. Collections partly labeled. Peak display: June and September. Trail.

Directions Campus is at 2nd South and University Sts., 2 miles east of the downtown area. Serviced by city buses.

See also International Peace Gardens in Jordan Park.

THE WEST COAST

CALIFORNIA

Arcadia. Los Angeles State and County Arboretum 301 N. Baldwin Ave., Arcadia, California 91006 (213-446-8251). Established 1953. Operated by County of Los Angeles Dept. of Arboreta and Botanic Gardens. Part financial support from California Arboretum Foundation (membership organization).

Children's and adult instruction programs, including credit and non-credit courses with Pasadena City College and University of California at Los Angeles. Also courses for professional gardeners. Lecture series.

Brochure. Quarterly publication: *Lasca Leaves*. Occasional flower shows. Gift and book shops. Tram tours. Picnic area, snack bar.

Hours 8 A.M.-5:30 P.M. in summer, 8:30 A.M.-5 P.M. in winter. Closed Christmas. **Area** 127 acres. Staff of 100 (County Dept. total 150). **Kinds of plants** 4,500. A relatively young botanic garden at the foot of the San Gabriel Mountains, but an old historical site of note (it was once part of the Mission San Gabriel. Arboretum has several old buildings). Some 200 peacocks, descendants of ones brought from India by silver baron E. J. Baldwin in the 1880's, roam the grounds.

The grounds are planted partly along geographical lines (*e.g.*, Australian, Mediterranean, African, Asian sections), but there are several special gardens within the larger framework. Among them are herb; Braille; rose; biblical; annual-perennial gardens. There is also a home demonstration garden (in cooperation with *Sunset Magazine*). Ground covers, turf plots.

Main collections: eucalyptus; bottlebrush; palm; cassia; acacia; holly; magnolia and juniper. Venerable specimen trees: mesa oaks (*Quercus engelmannii*); Coast live oaks (*Quercus agrifolia*); *Ficus sycomorus*. A 100-year-old Wolfskill eucalyptus or blue gum (*Eucalyptus globulus*) is 175 feet tall.

Greenhouse (10 A.M.-4 P.M.) has begonia display, also an extensive orchid collection



One-hundred-year-old Wolfskill eucalyptus, 175 feet tall, towers over Queen Anne Cottage at Los Angeles State and County Arboretum in Arcadia, California.

(*Cattleya*, *Cymbidium*, *Paphiopedilum*).

There are two subsidiary gardens—**Descanso Gardens** in La Canada and **South Coast Botanic Garden** on Palos Verdes Peninsula. *See respective listings.*

Directions State and County Arboretum is 12 miles northeast of Los Angeles (center). From San Bernadino Frwy., take Baldwin Ave. Exit and go north $5\frac{1}{2}$ miles to garden entrance. Public transportation: No. 52 bus north from Main St. in Los Angeles to Huntington Dr. & Baldwin Ave., then $\frac{3}{4}$ mile north on Baldwin by foot. If coming from Pasadena, 3 miles west of the Arboretum, take No. 108 bus on Colorado Blvd. to Baldwin Ave., then walk south $\frac{1}{2}$ mile.

See also: Claremont (Rancho Santa Ana Botanic Garden), Los Angeles (Botanical Gardens, U.C.L.A.), Riverside (University Botanic Gardens), and San Marino (Huntington Botanical Garden).

Berkeley. Regional Parks Botanic Garden Charles Lee Tilden Regional Park, Berkeley, California 94708 (415-848-7117). Established 1940. Operated by East Bay Regional Park District. Brochure. Occasional journal: *The Four Seasons*.

Guided tours for groups by appointment. Plant sales by California Native Plant Society. Picnic areas in surrounding park. Restaurant at nearby golf course, or at carousel.

Hours 10 A.M.–5 P.M. **Area** 7 acres cultivated (13 acres in reserve; entire park has 3,300 acres). **Staff** of 7. **Kinds of plants** 1,500. (A parks department enterprise separate from university garden in Berkeley. *See next listing*). Plants native to California are emphasized.

Special gardens: dune, sea bluff, alpine and mountain meadow. Main collections: manzanita (*Arctostaphylos*); ceanothus; wild-buckwheat (*Eriogonum*). Oaks and other broad-leaved trees. Conifers.

Specimen trees: Santa Lucia fir (*Abies bracteata*); red fir (*A. magnifica*); Santa Cruz ironwood (*Lyonothamnus*); California-nutmeg (*Torreya californica*); redwood; giant-sequoia. Wildflowers. Peak display: April-May, but good at other

times of year. Lowest point is September, just before autumn color.

Directions Garden is in Charles Lee Tilden Regional Park, in the hills northeast of Berkeley. Garden is about 14 miles east of San Francisco.

Berkeley. University of California Botanical Garden Centennial Rd., Berkeley, California 94720 (415-642-6000). Founded early 1890's (present site 1928). Operated by Botany Dept. Adult extension-service courses in horticulture. Children's classes, including outdoor biology program in summer. Booklet: *Indian Nature Guide*, 25 cents. Picnic area.

Hours 9 A.M.–5 P.M. (winter 9 A.M.–4 P.M.). **Area** 25 acres. **Staff** of 8. **Kinds of plants** 12,000. A major university botany garden. Garden of cacti and other succulents has many South American kinds. Rhododendron dell has rare mild-climate species brought to America from southern China by noted plant explorer J. F. Rock.

Other points of interest: herb garden; native plant section; Indian nature trail and exhibit of plants used by Indians. Major greenhouse collections: fern, orchid, succulents. Peak garden display: April-May. Specimen tree: Monterey pine (*Pinus radiata*).

Satellite gardens (research): **Russell Tree Farm Bodega Head** and **Sage Hen Creek Field Station**.

Directions Garden is 2 miles east of Berkeley. Follow University Ave. eastbound, turn left on Oxford, then right on Hearst Ave. The Garden is in Strawberry Canyon, behind stadium. It is about 12 miles east of San Francisco (*see listing*).

Also in Berkeley: Municipal Rose Garden in Codornices Park, Euclid Ave. & Bayview Pl. It has about 4,000 rose bushes.

Claremont. Rancho Santa Ana Botanical Garden 1500 N. College Ave., Claremont, California 91711 (714-626-3922). Established 1927 (moved to current site 1950-52). Administered by the John W. Bixb

Foundation (privately endowed), with additional financial support from individual citizens and National Science Foundation grants to staff members.

Garden is affiliated with Claremont Graduate School and Pomona College in a graduate level botany program. Youth education program. Brochure. Gift shop. Picnic area nearby.

Hours 8 A.M.-5 P.M. Closed major holidays. **Area** 83 acres. **Staff** of 23.

Kinds of plants ca. 1,350. A native plant garden devoted entirely to indigenous California flora. One of the most extensive of its kind in the country. One garden consists of native plants useful in the home landscape.

Garden has manzanitas (*Arctostaphylos*); wild-lilacs (*Ceanothus*); hush-anemone (*Carpenteria californica*); flannel-bush or fremontia (*Fremontodendron californicum*); desert-willow (*Chilopsis linearis*) and others. Many nature trails. Best time to visit: late February to mid-June.

Directions Garden is immediately north of Foothill Blvd. (Rte. 66) in Claremont. Claremont is 35 miles east of Los Angeles.

Davis. University Arboretum University of California, Davis, California 95616 (916-752-1011). Established 1936. Operated by Botany Dept., with support from "Friends of the Davis Arboretum." Guided tours by appointment. Picnic area.

Hours Open continuously. **Area** 67 acres. **Staff** of 10. **Kinds of plants** 5,000. Arboretum has a scenic location along the meandering Putah Creek. Weier redwood grove. Shields Grove (28 acres devoted to oaks and their near relatives).

Major collections: eucalyptus (80 species); oak (75 species); acacia; ceanothus; hakea; bottle-brush (*Callistemon*); melaleuca; casuarina; iris. The Arboretum has what is thought to be the country's only cone-bearing tectate cypress (*Cupressus guadalupensis*). Peak display: late February through April.

Directions Arboretum is on Davis campus, 15 miles west of Sacramento via Interstate 80.

Encinitas. Quail Botanic Gardens 230 Quail Gardens Dr., Encinitas, California 92024. Former estate of Ruth Baird Larabee, with plantings from about 1944, became botanic garden in 1960. It is part of the San Diego Parks System, but plantings and other activities are the responsibility of Quail Gardens Foundation, a volunteer group.

Guided tours for groups by reservation. Slide lectures, nature photography classes, occasional plant sales. Brochure, map and calendar. Small picnic area. Restaurants in town.

Hours 8 A.M.-5 P.M. **Area** 27 acres. **Staff** of 3 (5), plus volunteers. **Kinds of plants** 750-1,000, oriented to interests of home gardeners of southern California. Within the larger framework: desert; protea and hromeliad gardens. Collections-in-the-making: Australia-New Zealand woody plants; subtropical fruit trees; native flora.

Young specimen trees include meta-sequoia; cork oak (*Quercus suber*); floss silk-tree (*Chorisia speciosa*). Eucalyptus and acacia in variety. Variegated banana; others. Collections partly labeled. Ideal time to visit: March-May.

Directions Gardens are 25 miles north of San Diego via Interstate 25. Take Encinitas Blvd. Exit and go east $\frac{1}{2}$ mile to Quail Gardens Dr., then north $\frac{1}{2}$ mile to entrance. Accommodations along Coast Highway (Rte. 101) between Oceanside and San Diego. Encinitas is about 90 miles south of Los Angeles.

La Canada. Descanso Gardens 1418 Descanso Dr., La Canada, California 91011 (213-681-0331). Land purchased in 1937 by camellia-enthusiast Manchester Boddy. Obtained by Los Angeles County Dept. of Arboreta and Botanic Gardens in 1954. Part financial support by Descanso Gardens Guild. Children's and adult instruction programs. Tram tours. Brochure. Gift shop. Picnic area and restaurant (Japanese tea garden).

Hours 8 A.M.-5:30 P.M. Closed Christmas. **Area** 150 acres. **Staff** of 20. **Kinds of plants** ca. 1,500. In part, a woodland



Display of cacti and other desert plants at Quail Botanic Gardens, Encinitas.

garden with an extensive range of camelias planted under a canopy of coast live oak (*Quercus agrifolia*).

Sizable rose garden has old-time as well as modern roses. Japanese and Chinese gardens. Lilaes, iris, lilies, annuals. Native plant garden. Trails. Ideal time to visit: January 1-April 1; also of interest later in the season. Collections partly labeled.

Directions Gardens are 10 miles north of Los Angeles (center), 11 miles northwest of Arcadia, site of the parent garden, Los Angeles State and County Arboretum. Descanso Gardens are immediately south of Foothill Blvd. in La Canada.

See also **Los Angeles** area gardens under **Arcadia**.

Los Angeles. **U.L.C.A. Botanical Garden** Hilgard & Le Conte Aves., University of

California, Los Angeles, California 90024 (213-825-4321). Established 1929. Information available at Garden headquarters in Botany Building, Tiverton Ave. & Buenos Ayres Dr.

Guided tours for groups by appointment. Trail guide brochure, also U.C.L.A. campus tree-tour booklet. Picnic area in Garden; restaurant in nearby Medical Center.

Hours 8 A.M.-5 P.M. weekdays, 10 A.M.-4 P.M. weekends. Closed holidays.

Area 8 acres. Staff of 10. **Kinds of plants** 3,500. Points of special interest: desert garden, native plant area.

Principal collections: eucalyptus; acacia; melaleuca; aloe; California flora. Nature trails. Garden is at its best in April and May.

U.C.L.A. also operates a **Japanese Garden** (2 acres), 1 mile north of campus. It is open by appointment only, Tuesdays and Wednesdays. Call Visitors Center at

the University (213-825-4338).

Directions To reach Garden from San Diego Frwy. (Interstate 405), take Wilshire Ave. Exit and proceed east to Westwood Blvd., then go left (north) to campus. At the campus parking kiosk, request directions to Botanical Garden. Public transportation: Wilshire bus to U.C.L.A.

See also **Los Angeles** area gardens under **Arcadia**.

Mill Valley. Muir Woods National Monument Mill Valley, California 94941. Major part of the land was given to the government in 1908 by Congressman and Mrs. William Kent. Operated by National Park Service. Admission: 50 cents per person over 15. Brochure. Publication: *Flowers and Ferns of Muir Woods*. Gift shop. Picnic area at Muir Beach, 3 miles away.

Hours 8 A.M.-dusk. **Area** 500 acres. Staff of 9. **Kinds of plants** 200. One of a number of places in coastal California to see the tallest-growing tree of North America—the redwood (*Sequoia sempervirens*). The woods are dark, dank and awesome. Local flora trails, with some plants labeled.

Directions This monument is close to San Francisco (Muir Woods is 12 miles north via Rtes. 101, 1).

Editor's Note: Many state and national parks in California—and elsewhere in the West—carry out functions partly of an arboretum nature; some have visitors' centers, self-guiding trails, special areas devoted to representative plants which are labeled, and native flora guidebooks. Some have organized nature programs.

A few of the major California parks serving these functions are: **Angeles National Park**, Pasadena; **Big Basin Redwoods State Park**, near Pescadero; **Cleveland National Forest**, Pine Valley; **Humboldt Redwoods State Park**, Burlington; **Inyo National Forest**, Mammoth Lakes; **Joshua Tree National Monument**, Joshua Tree; **Sequoia and Kings Canyon National Parks**, Porterville; **Shasta-Trinity National Forests**, Trinity Lakes;

Yosemite National Park, Yosemite Village.

Palos Verdes Peninsula. South Coast Botanic Garden 26701 Rolling Hills Rd., Palos Verdes Peninsula, California 90274 (213-377-4564). Established 1960-61 (once part of Rancho San Pedro). Under jurisdiction of Los Angeles County Dept. of Arboreta and Botanic Gardens. Part financial support from South Coast Botanic Garden Foundation, a membership organization.

Children's and adult instruction programs. Guided tours for groups by appointment. Annual flower show. Picnic areas and restaurants nearby.

Hours 10 A.M.-4 P.M. Thursday-Friday; 10 A.M.-4:30 P.M. Saturday-Sunday. **Area** 87 acres. Staff of 29. **Kinds of plants** 2,030. A new garden, still in the development stage, but with an interesting background. Diatomaceous earth from this site was once used in pottery-making. The resulting hole was later employed as a sanitary landfill (*i.e.*, dump) by the County, then transformed to a garden. (Brooklyn Botanic Garden has had a similar history in that the major part of the site was an ash dump until the Garden's formation in 1910.)

Main collections: California native plants including cassia and other legumes; *Ficus*; also members of the myrtle, protea and rose families. Of special interest: youth education practice gardens. Best times to visit: January; March-June; September-October.

Directions Botanic Garden is a short distance south of the town of Torrance and the Pacific Coast Hwy. (Rte. 1). Garden is about 20 miles south of Los Angeles (center).

See also **Arcadia**, site of the parent garden, **Los Angeles State and County Arboretum**.

Riverside. University Botanic Gardens School of Biological and Agricultural Sciences, University of California, Riverside, California 92502 (714-787-1012).

(Continued)

Founded 1962.

Hours 9 A.M.—3 P.M. weekdays. **Area** 35 acres. **Staff** of 3. **Kinds of plants** 2,000. A very new garden, still in the initial stages of development. The emphasis is on Australian and dry-climate plants. Collection partly labeled. Intended primarily for teaching and research.

Directions Riverside is 50 miles east of Los Angeles.

San Francisco. Strybing Arboretum Hall of Flowers, 9th Ave. & Lincoln Way, Golden Gate Park, San Francisco, California 94122 (415-661-0822). Arboretum started in the late 19th century under John McLaren, a Scottish-born gardener and key figure in transforming a sand barren into one of the nation's most attractive parks—**Golden Gate Park**. Arboretum was officially established in 1937 through a bequest of Mrs. Helen Strybing to the city.

Operated by San Francisco Recreation and Park Dept. The Strybing Arboretum Society, a membership organization, supports educational program and other activities. "Teach the Teachers" program. Adult lecture series. Spring plant sale. Flower shows.

Guided tours for groups by appointment. Arboretum map 10 cents, plant list \$2.07. *California Horticultural Journal* includes "Arboretum Notes." Information kiosk sells various publications. Picnic areas in surrounding park. Cafeteria in California Academy of Sciences building, a short distance east of the Arboretum.

Hours 8 A.M.—4:30 P.M. weekdays; 10 A.M.—5 P.M. weekends and holidays. **Area** 40 acres (in a 1,017-acre park). **Staff** of 12. **Kinds of plants** over 3,000. A major arboretum that gives the impression of maturity because of large, striking Monterey pines (*Pinus radiata*), but much of the grading and landscaping took place only in the late 1940's and 1950's. Attractive vistas and arrangements of plants.

Strybing Arboretum is in a benign climate for plant growth, and the range of trees and shrubs, from subtropical to cold-temperate, that are successfully cul-

tivated is formidable. There are not many places in America where Alaska-cedar or Nootka-cypress (*Chamaecyparis nootkensis*) and New Zealand Christmas-tree (*Metrosideros excelsa*) can be equally at home.

Special gardens: dwarf conifer, rock, home demonstration (in conjunction with *Sunset Magazine*), native flora. Fragrance garden is one of the most handsome of its kind. Redwood nature trail.

Especially outstanding collections: magnolia; warm-climate (Malesian) rhododendron; Australian and New Zealand plants; echeveria. Conifers, cotoneasters, crab-apples.

Specimen trees: Campbell magnolia (*Magnolia campbellii*); M.c. 'Helen Strybing'; *M. sprengeri* diva; *M. sargentiana robusta*; other magnolia species. Also *Michelia doltsopa* (a magnolia relative from the Himalayas). Mayten-tree (*Maytenus boaria*). Rimu (*Dacrydium cupressinum*). *Podocarpus totara*; Santa Lucia fir (*Abies bracteata*), other conifers.

Directions Arboretum and Golden Gate Park are west of the downtown area. Best obtain city map. Public transportation: N. Street Car (dismount at 9th & Irving and walk one block to Arboretum entrance); Nos. 10, 71, 72 buses go to entrance.

Also in Golden Gate Park: Japanese Tea Garden (established 1894) (8 A.M.—dusk), opposite the northeast corner of the Arboretum and near the California Academy of Sciences buildings; **Park Conservatory** (8 A.M.—4:50 P.M.) on Kennedy Dr. near Arguello Blvd.

See also Berkeley; Mill Valley.

San Marino. Huntington Botanical Gardens 1151 Oxford Rd., San Marino, California 91108 (213-792-6141). Established 1929 (Georgian mansion dates from 1910). Privately endowed. Additional support from "Friends of the Huntington Library," a membership organization.

Gardens are on the grounds of the Henry E. Huntington Library and Art Gallery. Library has Gutenberg Bible, Shakespeare First Folio, other rare books

Strybing Arboretum in San Francisco's Golden Gate Park is famous for magnolias, one of the more rare species being *Magnolia campbellii*, shown here in bud and flower.



and manuscripts. Gallery has many well known paintings, including Gainsborough's "Blue Boy."

Brochure, various guide books (charge). Publications on camellias, palms. Book shop. Guided tours. Picnic area in nearby city park.

Hours 1 P.M.-4:30 P.M. Tuesday-Sunday. Closed Mondays and the month of October. **Area** 207 acres. Staff of 40. **Kinds of plants** 9,000. The former private home of a real estate tycoon and philanthropist. Attractively landscaped grounds, with broad lawns and vistas.

The collection of cacti and other succulents, consisting of some 2,000 species in a special 10-acre section of the Garden, is thought to be the most extensive on the Continent. Garden also has 1,500 camellia cultivars. Other notable collections: palm, cycad, conifer, Australian plants.

Other gardens within the larger framework, in addition to the desert garden: Shakespeare; herb; Japanese; rose. Among the many fine specimen trees: deodar cedars (*Cedrus deodara*); Queensland kauri (*Agathis*); araucarias. Garden is of interest any time of year, but peak periods are February-April (camellias) and May-July (desert plants).

Directions Garden is 12 miles northwest of Los Angeles (center). From San Marino Ave. northbound, go left on Ox-

ford Rd. and follow directional signs. Accommodations in nearby Pasadena. San Marino is 5 miles west of Arcadia (Los Angeles State and County Arboretum).

See also Arcadia for other nearby gardens.

San Simeon. Hearst San Simeon State Historical Monument San Simeon, California 93452 (805-927-4621). Constructed 1920-36; opened to the public in 1958. Operated by California Dept. of Parks & Recreation. Brochure. Guided tours only, \$3 (price varies according to tour). Advance reservations may be made from Hearst Reservation Office, Dept. of Parks & Recreation, Box 2390, Sacramento 95811. Picnic area nearby. Restaurant 8 miles south.

Hours 8 A.M.-3:30 P.M. except major holidays. **Area** 85 acres. Staff of 9 (12). Former estate of newspaper publisher William Randolph Hearst. Grandiose and of its own kind. More-or-less Moorish castle, terraces on a steep hill overlooking the Pacific Ocean.

Five acres of formal gardens. Cedar of Lebanon; columnar Italian cypress; Coast live oak; redwood; eucalyptus; acacia and other specimen trees in arboretum. Plants not labeled. Peak flowering display: April 15-May 15. Also autumn.

(Continued)

Directions San Simeon is 150 miles south of San Francisco along the coast. Accommodations on Rte. 1 three miles south of San Simeon, also in Cambria, ten miles south. Organized tours from San Francisco.

Santa Barbara. **Santa Barbara Botanic Garden** 1212 Mission Canyon Rd., Santa Barbara, California 93105 (805-963-1886). Founded 1926. Privately endowed, with partial support from Santa Barbara Botanic Garden Association.

Botany and horticultural courses for adults. Instruction greenhouse. Children's program. Lectures, field trips and plant sales for members. There is a regular guided tour for visitors on Thursdays at 10:30 A.M.

Guide booklet to Garden 35 cents. Periodical: *Leaflets of the Santa Barbara Botanical Garden* (published at irregular intervals). Miscellaneous publications on local flora. Book shop. Picnic area in nearby county park.

Hours 8 A.M.-dusk. Closed on rainy days. **Area** 65 acres. Staff of 14. **Kinds of plants** about 1,000. An informal garden of California native plants. Attractive setting in the foothills of the Santa Ynez Mountains. Garden includes a cross-section of Mission Canyon. Grounds have a dam and aqueduct, built in 1807 by Indian labor to supply water to Mission Santa Barbara. History trail.

Points of special interest: desert plant section, meadow of California-poppies and other wildflowers. One part of the Garden is devoted to the unique flora of California's Channel Islands. Native cypress trees (*Cupressus*); wild-lilacs (*Ceanothus*); chaparral plants. Old Coast live oaks (*Quercus agrifolia*); big-cone Douglas-fir (*Pseudotsuga macrocarpa*).

Spring wildflowers in variety and abundance. Nature trails. Best time: March to May.

Directions Botanic Garden is about 3 miles north of Santa Barbara. Take Rte. 101 to Los Olivos St. (end of 2100 block). Turn right on Los Olivos and follow signs to Garden from Mission Santa Barbara. Garden is about 1½ miles north of the

Mission. It is also about 95 miles northwest of Los Angeles along the coast.

Other California gardens: **Mendocino Botanical Gardens**, Rte. 1, Fort Bragg (fee); **Roeding Park**, W. Belmont Ave. & Rte. 99, Fresno; **Japanese Garden**, 666 Bellevue Ave., Oakland; **Lakeside Park Trial and Show Gardens**, Oakland; **Pacific Grove Museum of Natural History**, Forest & Central Aves., Pacific Grove; **Rosecroft Begonia Gardens**, 510 Silvergate Ave., Point Loma (fee); **State Capitol grounds**, Sacramento; **Balboa Park**, San Diego; **Japanese Friendship Garden**, Senter Rd. & Alma, San Jose; **Japanese Garden** in Central Park, San Mateo; **Villa Montalvo**, Saratoga; **Busch Gardens**, 16,000 Roscoe Blvd., Van Nuys.

OREGON

Portland. **Hoyt Arboretum** 4000 Fairview Blvd., Portland, Oregon 97221 (503-228-8732). Established 1928. Operated by Bureau of Parks of Portland. Brochure, map. Bulletin: *Trees for Portland Home Gardens*. Guided tours. Picnic area. Restaurant at adjoining zoo.

Hours 7:30 A.M.-4 P.M. **Area** 214 acres. Staff of 4. **Kinds of plants** 650. An extensive collection of cone-bearing trees, one of the country's largest, on a steep and rustic hillside above city of Portland.

Conifers grow well here, and visitors may see most of the commonly cultivated species as well as Santa Lucia fir (*Abies bracteata*); western yew (*Taxus brevifolia*); California-nutmeg (*Torreya californica*); Siskiyou spruce (*Picea breweriana*) and Sitka spruce (*P. sitchensis*). Collection partly labeled.

Directions From downtown area: go west on Burnside St. to Fischer La., then left to Fairview Blvd. Public transportation: Arlington Heights bus to last stop, then walk west on Fairview Blvd. to Arboretum.

Also nearby: Two other notable gardens on the "downhill" side of the Arboretum, but commanding fine views of the city. **The International Rose Test Garden**, S.W. Kingston Ave. (top of



Josef Muench

This pool in the Santa Barbara Botanic Garden is surrounded by native plants.

Washington Park) has exceptionally well grown bushes.

Across the street is the **Japanese Garden** (fee), a 5½-acre series of gardens designed by P. Takuma Tono. While planting was still taking place in 1969, it is clearly one of the finest gardens of its kind in the U.S. It was constructed by the Portland Park Bureau, although all financial support has come from private sources. The Japanese Garden Society of Oregon has been instrumental in the creation of this garden.

Portland. Rhododendron Society Garden c/o Portland Chapter of the American Rhododendron Society, Box 14773, Portland, Oregon 97214. Garden is on S.E. 28th Ave., 1 block north of Woodstock and across the street from Reed College. Established 1950.

Land city-owned, but operated by Portland Chapter. Admission free except during Show on Mother's Day weekend (50 cents). The American Rhododendron Society originated in Portland. It publishes a quarterly bulletin for members (information from Mrs. William Curtis, Executive Secretary, 24450 S.W. Grahams Ferry Rd., Sherwood, Oregon 97140). Handbook: *Rhododendron Information*, \$6.95.

Hours Open continuously. **Area** 6 acres. Staff of 1. Garden has over 300 rhododendron species, 400 cultivars, with companion plants in a beautiful woodland setting. Large-flowered varieties are planted on the sides of a ravine; others on 4-acre island.

Directions Public transportation from downtown Portland: take Eastmoreland bus from corner of Southwest 3rd and Alder. Ask driver for stop.

WASHINGTON

Seattle. University of Washington Arboretum Seattle, Washington 98105 (206-543-8800). Established 1936. Operated by College of Forest Resources. Supported from "Friends of University of Washington Arboretum" and "The Arboretum Foundation." Brochure. Booklet

75 cents.

Guided tours for groups by appointment. Adult classes (University short-courses). Quarterly publication: *The University of Washington Bulletin*. Plant sales in spring and autumn. Picnic area.

Hours Open continuously. Office open 8 A.M.-5 P.M. weekdays. **Area** 200 acres. Staff of 16. **Kinds of plants** ca. 4,500. While it is in a woodland setting, the Arboretum has one of the country's largest collections of rare woody plants.

Uncommonly sizable collections: maple; rhododendron and azalea; camellia; conifer; mountain-ash (*Sorbus*); cherry and other *Prunus*; broad-leaved evergreens. Many fine specimen trees and shrubs, including Nootka-cypress.

One of the most handsome tree groupings in the Arboretum is made up of a rare smooth-leaved elm cultivar, *Ulmus carpinifolia* 'Gracilis.' These trees have the same shape as ice-cream cones and look as though they would topple in a good wind, although they have clearly been growing on the same site for a number of years.

Several species of southern-beech (*Nothofagus*), almost unknown in American gardens, are grown here as well as the medlar-hawthorn hybrid (*Crataegomespilus*). Native flora. Trails. Ideal time to visit: late March-May, October.

The Arboretum has a sizable Japanese garden (25 cents fee) constructed around a meandering pond. Bristlecone pine, maples and other trees have been form-trained. Hours for this garden: 10 A.M.-dusk, April to mid-November; weekends only in winter. Arboretum also has a small display greenhouse (8 A.M.-4 P.M.).

Directions Arboretum is about a 20-minute walk from the University of Washington campus. Entrance on E. Madison & Lake Washington Blvd. E.; also, Lake Washington Blvd. E. and Foster Island Rd. E.

On the campus proper is an extensive **Drug Plant Garden**, operated by the College of Pharmacy.

Also in Washington: Finch Arboretum, 3404 Woodland Blvd., Spokane. Rhododendrons.



North vista in the Huntington Botanical Gardens in San Marino, California.

HAWAII

Kalaheo. Olu Pua Botanic Garden Box 518, Kalaheo, Kauai, Hawaii 96741. Opened to the public in 1968. Owned by Mr. and Mrs. Ray Lauchis. Admission fee: adults \$1, children under twelve 50 cents. Brochure.

Guided tours for school classes and adult groups. Garden workshops. Sale of plants, seeds, cuttings and material for dried flower arrangements. Picnic area.

Hours 8:30 A.M.-5 P.M. **Area** 12 acres. Staff of 8. **Kinds of plants** 3,000. The owners' aim is to preserve the limited but unique native flora of Kauai and to display a range of representative and rare exotic plants that are adaptable to the climate of this Hawaiian island.

Special gardens within the larger framework: Kau Kau (food); Oriental; sunken; palm; terrace (annuals); bromeliad; succulent; New Zealand-Australian. One garden is devoted to plants with blue flowers. Jungle walk. Lath-house display.

Main collections: Hawaiian plants; orchids; Peruvian aroids; uncommon flowering trees; tropical food plants. Warm-climate fruit trees and shrubs (Surinam-cherry; soursop; sweetsop; eggfruit; star

fruit and others).

Garden has a variegated Chinese fountain palm (*Livistona chinensis*), which the owners think may be the only one of its kind. A 20-year-old banyon tree (*Ficus*) has a spread of 100 feet.

Directions Garden is 12 miles west of Lihue via Rte. 50 and is on the western outskirts of Kalaheo. Accommodations in Lihue and the Poipu Beach area.

Also in Hawaii: Foster Botanic Garden 50 N. Vineyard Blvd., Honolulu. Aroids, orchids, palms. **Hours:** 9 A.M.-4:30 P.M.

VIRGIN ISLANDS

St. Thomas (Charlotte Amalie). Saint Thomas Gardens "Orchidarium," 6-37 Contant, St. Thomas, Virgin Islands 00801 (809-774-5530). Begun 1969. Privately owned. Admission: outdoor tropical garden free; Orchidarium (greenhouse) \$1.50 for adults, no charge for children under 12. Guided tours at 11:30 A.M. and 3:30 P.M. Garden shop sells plants. Restaurant on premises.

Hours 8:30 A.M.-5 P.M., Monday-Saturday. **Area** 6 acres. Staff of 10. Orchids and tropical foliage plants. Year-



Canada Dept. of Agriculture

The rock garden within the Dominion Arboretum and Botanical Garden, Ottawa.

round display.

Directions Gardens are one block off main highway

Water Island. Water Isle Botanical Garden Water Island, St. Thomas, Virgin Islands 00801 (809-774-1213). Established 1954. Privately endowed, with support from membership. Guided tours. Gift shop. Restaurant and accommodations at nearby Water Isle Hotel. Picnic area at Honeymoon Beach.

Hours 8 A.M.-2 P.M. **Area** 25 acres. Staff of 4. **Kinds of plants** 3,000. Orchid and cactus gardens. Three greenhouses. Collections of agave, succulents. Native flora of Virgin Islands. Specimen plants include flamboyant-tree or royal poinciana (*Delonix regia*); bougainvillea.

Directions Water Island is $\frac{1}{2}$ mile from St. Thomas. Transportation: boat from St. Thomas Submarine Base.

CANADA

Edmonton. Botanic Garden Field Laboratory University of Alberta, Edmonton, Alberta (403-432-3484). Founded 1959. Operated by Botany Dept., with support from membership (Friends of the Botanic Garden).

Hours 1 P.M.-7 P.M., Saturdays, May-August; other times by appointment. **Area** 80 acres. Staff of 4 (10). **Kinds of plants** 2,450. Of special interest: native plants of Alberta; *Primula*; *Allium*; Welsh-poppies (*Meconopsis*); peonies (75 species and varieties). Iris dell. Shrub garden. Specimen trees: Jack pine (*Pinus banksiana*), canoe birch (*Betula papyrifera*).

Plant hardiness trials are an important feature of the Arboretum, since winter temperatures sometimes fall to -50F.

Much of the Arboretum is in an early stage of development. Under construc-

tion: herb, rose and rock gardens; local flora garden (with reconstituted prairie); nature trails; systematic garden.

Directions Botanic Garden is 6 miles west of Edmonton on Hwy. 16, then 9 miles south on Hwy. 60. Accommodations in Edmonton.

Hamilton. Royal Botanical Gardens Postal Station "A," Box 399, Hamilton 20, Ontario (416-527-1158). Established 1941 by provincial statute. Supported by municipal and county taxes, grants, members' assn., and women's committee. Statutory connections with McMaster University. Descriptive brochure \$1. Publications: *The Gardens' Bulletin* (quarterly); *Horticultural Leaflets*. Nature center with exhibits. Adult and children's educational programs, including children's garden. Floral Art Shop. Picnic areas (see below). Tea house—restaurant in rock garden.

Hours Dawn—dusk. **Area** 2,000 acres. Staff of 30 (55). A series of attractively landscaped, well-maintained gardens within a larger framework. Because the points

of garden interest are separated by rolling woodlands, visiting by car is recommended.

Principal points of interest: Katie Osborne Lilac Garden at Arboretum; Iris Garden at Spring Garden; Centennial Rose Garden and Trail Garden (annuals) in Hendrie Park; Rock Garden (a large area with a broader range of plants than is usually included in rockeries).

Herbaceous plant groups of special interest: iris; peonies; day-lilies; and lilies. Trees and shrubs: lilacs (extensive collection); magnolia; crab-apple; *Prunus*; roses. Hedge exhibit. Peak flowering period: May 15-31; June 5-15; summer (annuals and perennials). Autumn color: October 10-31.

Natural areas within the Botanical Gardens: Cootes Paradise Sanctuary; Hendrie Valley and Rock Chapel Sanctuary (geology and maple exhibits). Contains 25 miles of marked nature trails. Picnic facilities at Principal Point, Hendrie Valley and Rock Chapel Sanctuary.

Directions Gardens are in the Hamilton-Burlington area, along Hwy. 2, and are easily accessible from Queen Eliza-



Richard Divold

A view inside the Orchidarium of the St. Thomas Gardens on the Virgin Islands.

beth Hwy. via Hwy. 403. Signs direct visitors to the Rock Garden first. Public transportation: via Grey Coach Bus (Hamilton-Burlington) or Toronto-Hamilton local line.

MacDonald College P.O. Morgan Arboretum Box 500, MacDonald College P.O., Quebec (514-453-2245). Established 1948. Under jurisdiction of McGill University, but with complete financial support from the Morgan Arboretum Association. Admission 50 cents. Brochure 25 cents. Demonstration Sugar Tours for groups and schools; also, educational nature tours by appointment.

Hours 9 A.M.-5 P.M. Open weekends only. **Area** 600 acres. Staff of 10. Complete collection of native Canadian trees. Paper birch and other nature trails.

Directions Arboretum may be reached from Montreal by Trans-Canada Hwy., Exit 26. From this exit, take Ste. Marie Rd. east to stop sign, then turn left to Arboretum entrance.

Montreal. Montreal Botanical Garden 4101 Sherbrooke St. East, Montreal 406, Quebec (514-872-2647). Established 1936. Division of the Parks Department of Montreal. Numerous leaflets on horticultural subjects (list on request). Color booklet on Garden 25 cents. Adult evening education program. Children's garden. Restaurant on grounds.

Hours 9 A.M.-dusk. Conservatories 9 A.M.-6 P.M. **Area** 180 acres. **Kinds of plants** about 22,000. The greenhouse collections are probably not surpassed anywhere in North America. Particularly strong groups are bromeliads; orchids; ferns; gesneriads; aroids; cacti and other succulents. Tropical rain forest. Seasonal displays (April, November, December).

While the arboretum is still in a planning stage, there are a number of noteworthy gardens. Among the most outstanding for their botanical interest: economic, aquatic and medicinal gardens. Medicinal garden has several sections, including ones devoted to poisonous plants and plants used by American Indians.

Fruit trees. Vegetables.

Other gardens: alpine (plants arranged by their geographical areas of origin); hedge; shrub; perennial; iris, day-lily and home-demonstration. Trials. In varying stages of completion: native tree collection; conifer collection and taxonomic garden.

The Botanical Garden is also responsible for the planting and maintenance of flower borders, trees and shrubs in City parks and along the streets of Montreal. It has a tree nursery of 300 acres in Terrebonne, 25 miles north of Montreal.

Directions By car: Sherbrooke St. east to Pie IX Blvd. (about 4 miles from center of town). Public transportation: Metro (subway) to Frontenac Station, then transfer to bus No. 185. Get off at corner of Pie X Blvd. and Sherbrooke.

Niagara Falls. Niagara Parks Commission's School of Horticulture Box 747, Niagara Falls, Ontario (416-358-7741). Established 1936. Under jurisdiction of the Ontario Provincial Government. Brochure. Picnic area and restaurants nearby.

Hours Dawn-dusk. **Area** 100 acres. Staff of 35, including students. Special gardens: rose, lily, lilac, iris, peony and wild gardens. There are larger-than-usual collections of herbs; annuals and perennials; evergreens; alpine and aquatic plants; fruits and vegetables. Peak display: end of June and in late August.

Directions Between Niagara Falls and Queenston, about 5 miles north of Niagara Falls (Canada). Take North Parkway to Queenston.

Ottawa. Dominion Arboretum and Botanic Garden Plant Research Institute, C.E.F., Ottawa 3, Ontario (613-994-5713). Established 1887. Operated by Canada Department of Agriculture.

Publications list on a wide range of horticultural subjects is available from Information Division, Canada Dept. of Agriculture, Sir John Carling Building, Ottawa 3, Ontario.

Hours Dawn-dusk. **Area** 135 acres.

Kinds of plants 10,000. Staff of 132 (including research). Within the larger framework are the Macoun Memorial Garden and rose, hedge and rock gardens. Display and test gardens (annuals, perennials).

Special collections: peony; iris; day-lily; crab-apple; lilac; shrubby potentilla and *Caragana*. Greenhouse open for special displays. Annual chrysanthemum show. Peak garden displays: May-June; mid-August to mid-September.

The Arboretum has the oldest woody plant collection in Canada. Some of the less common specimen trees are Korean mountain-ash (*Sorbus alnifolia*); umbrella magnolia (*Magnolia tripetala*); Macedonian pine (*Pinus peuce*); Bebb and Mongolian oaks (*Quercus bebbiana*, *Q. mongolica*); and Asiatic maples (*Acer mono*, *A. miyabei*). Bald-cypress (*Taxodium distichum*) and many other trees appear to have their northern hardiness limit here.

Directions Dominion Arboretum and Botanic Garden, reached by Prince of Wales Hwy. and Driveway, is on the southern outskirts of Ottawa. Public transportation (bus): OTC No. 92 or 69. Picnic facilities nearby in Massey Park.

Vancouver. Botanical Garden of the University of British Columbia Vancouver 8, British Columbia (604-228-3928). Founded 1916. Admission: adults 25 cents; children 10 cents. Brochure. Publication: *Davidsonia* (quarterly).

Hours 10 A.M.-dusk; greenhouses, 8:30 A.M.-4:30 P.M. **Area** 78 acres. Staff of 13. Extensive rhododendron collection, effective in flower from mid-April to late May. Rose and Japanese gardens. There is also a garden devoted to Indian totem poles and economic plants used by Indians. Specimen tree: Pacific dogwood (*Cornus nuttallii*). Botanic Garden is in a period of expansion.

Directions University of British Columbia is 8 miles west of Vancouver center, via University Blvd.

Also in Vancouver: Queen Elizabeth Park and its **Bloedel Tropical Conservatory** (Triodetic Dome).

Victoria. Butchart Gardens Ltd., Box 4010, Postal St. "A," Victoria, British Columbia (604-652-2066). Established 1902. Privately owned. Admission: adults, \$2; children 13-17, \$1.25; ages 5-12, 75 cents. No charge from November 1 to March 31.

Brochure. Seed catalog. Gift shop and seed store. Picnic areas, restaurant and coffee shop (June-September). Concerts. Guided tours by sightseeing bus (inquire in Victoria). Day tours (boat, bus) from Seattle, Washington.

Hours 9 A.M.-11:30 P.M. in summer (gardens illuminated at night); 9 A.M.-5 P.M. rest of year. A 135-acre estate of which 30 acres are open to public. Staff of 30 (180).

A major tourist attraction of western Canada, with the emphasis on bright flower color. The extensive flower borders are as well maintained as any in North America. Annuals are replanted frequently so there is a continuing "peak" display from spring to frost. Closely clipped, impenetrable lawns. British horticultural influence, including sense of upkeep, is apparent throughout the Gardens.

Special gardens: rose, Japanese, Italian, others. The sunken garden, perhaps the most outstanding display area, shows what can be done with an unattractive old quarry. Also of interest: daffodils and tulips in spring; tuberous begonias; Welsh-poppy (*Meconopsis baileyi*).

Trees at Butchart Gardens have been selected for season-round interest. Japanese maples and purple-leaf plums are extensively planted. Conifers. Variegated box-elder (*Acer negundo* 'Variegatum'), uncommon in American gardens, adds interest. Even the much maligned tree-of-heaven (*Ailanthus altissima*), with its vaguely tropical appearance, does not look out of place in the background of a flower border. Other trees: madrone (*Arbutus menziesii*), dove-tree, redwood. Maples provide good autumn color. Collections partly labeled.

Directions Butchart Gardens, on Benvenuto Dr., are 15 miles north of Victoria via Hwy. 17. Buses from Victoria. Wharf for boat arrivals.

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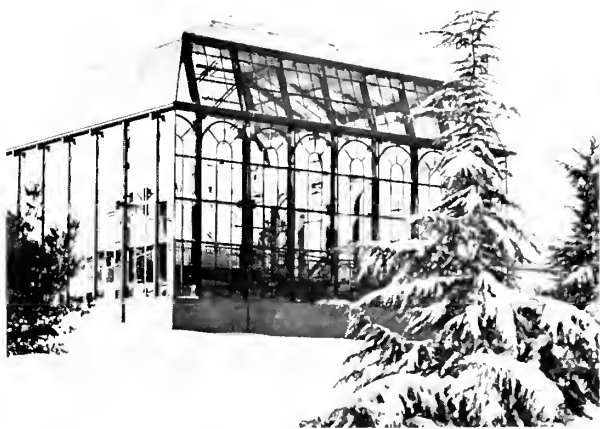
Area below parking lot showing part of palm garden, Olu Pua Botanic Garden.

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WINTER
1970-71

NEW SERIES



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For a list of topics see back cover.



M. M. Graff

The monarch birch (*Betula maximowicziana*) in the Brooklyn Botanic Garden. It was grown from seed received in 1932 from the Berlin Botanic Garden.

LETTER FROM THE BROOKLYN BOTANIC GARDEN

Readers of this issue will notice a somewhat greater than usual emphasis on ecology, plant pests and tree selection—three not unrelated subjects. As seasoned gardeners know, but do not proclaim loudly from the housetop, the successful cultivation of plants depends to a greater or lesser degree upon ecological considerations. The tree at the top of the hill does not necessarily thrive at the bottom, and the ground cover growing near a sandy beach may suffer if transplanted to clay soil. There are limits to what can and cannot be done in a garden, and most people who have had experience in growing plants are keenly aware of them. Gardeners were ecologists long before the seemingly magic word of ecology captured the imagination of a wide public, including soapmakers and orators.

Even under the best of growing conditions, a hybrid tea rose will have occasional problems, and gardeners will not be content with a lecture on the "balance of nature" when aphids or mildew are sapping the plant's vitality. Nature may set the overall limits to a garden, but a margin exists which is more or less under man's control. Even the "organic" gardener realizes this, although he may take special comfort in the biological axiom that no species becomes extinct because of disease alone. (Dr. Jaynes, for one, would prefer not to put the axiom to the test—see page 7.)

One part of the margin available to man has to do with the selection of trees, not only for their appropriate niche in the garden, but also in a more basic way. Over a fairly long period of time by gardeners' standards, plant breeders are able to develop trees for disease resistance, adaptability, shape or other characteristics. Over a shorter period, observant nurserymen, too, have an important role in the selection process by propagating the superior forms that they find.

A warm word of appreciation is due the individual contributors and fellow horticultural publications that have made it possible to bring this issue to you. Let us take the opportunity to thank them for their generosity in making these articles available to readers of **PLANTS & GARDENS**.

It is a special pleasure to report here that George S. Avery, Director Emeritus of the Botanic Garden, recently received the George Robert White Medal of Honor from the Massachusetts Horticultural Society. The award was in recognition of Dr. Avery's many contributions to horticulture, including **PLANTS & GARDENS**, which he originated in 1945.

The Brooklyn Botanic Garden has recently completed a 21-minute, 16 mm color film on **BONSAI**. Most of the scenes were filmed in the Garden's extensive bonsai collection, but there are also parts showing bonsai grown in homes and apartments. As in the earlier Botanic Garden films, **PRUNING PRACTICES** and **PLANTING AND TRANSPLANTING**, special attention is given to technique. For information on rental or purchase of any of these films, please write Mrs. Norman Free here at the Garden.

*The Editorial Committee
of the Brooklyn Botanic Garden*

Plant Selection and Design in the Home Garden

T. W. J. Wright

ASTRANGELY ironic and frustrating situation faces many gardeners and plantsmen at the present time. Never before in horticultural history has there been such an enormous range of hardy plants for use in gardens and yet gardens generally throughout the world are shrinking steadily in size. The problem is thus becoming one of too many plants and insufficient space to grow even a few of them.

Causes of the scaling down in garden size are not difficult to find. Land scarcity, population increases, housing densities and the demands of industry and services all mean that less and less space is left over for the garden area. Also, the counter attraction of all manner of leisure activities, especially motoring, and the greater mobility of population mean that generally less time, expressed in active gardening hours, is now spent in gardens today.

On the other hand, the pace and the tensions of living in the 1970's, especially in or near the big cities, increases the need for many to have a quiet and private retreat or sanctuary where for a few precious hours it is possible to escape and relax. The renewed concept of the medieval Italian 'secret garden' is now emerging fast so that gardens are becoming more introverted and enclosed places of passive relaxation. In more rural areas and for the energetic, the productive gardens yielding harvests of fruits, vegetables and flowers will continue to be an absorbing hobby, but increasing battles against predatory birds, insects and diseases and the abundance of frozen, kitchen-ready produce in the shops do not encourage even the most enthusiastic of gardeners.

The New Garden

The new gardens that are coming into being are therefore relatively small. They are green, restful havens offering the pleasures of growing and contemplating plants which require only modest maintenance in return. In this common situation the process of plant selection is important, and some thought might be given to the criteria that determine the plants people choose for their gardens.

Visual values always make the most impact. Plants are often selected because of their brilliant flowers, attractive foliage and, occasionally, autumn fruits. Habit and shape are also considered. Also important—physical characteristics, such as the effectiveness of the plant as a hedge, a screen or a structural barrier.

Finally, and so often these are the last to be considered, are the ecological requirements or, in brief, the plants' own adaptabilities to a particular garden site. All gardens can be thought of as habitats with certain very inherent and individual characteristics due to variations in exposure, climate and soil.

Ecology Observed

The garden owner would do well to leave his own small habitat before planting time and go to the open countryside where, if he chooses the right area, natural vegetation cover may be discovered—often stretching for mile upon mile, its thickness and attractiveness depending upon region or locality.

Standing amid this vegetation, whether it be of the heather moor, the alpine lawn or the broadleaf woodland, it makes an interesting exercise to consider what criteria have determined the type of vegeta-

tion it is and, in more detail, the variety or mixture of species of which it is composed. The plant ecologist knows that the flora or plant life of any region is intimately related to the characteristics of that region. Good examples of this relationship can be seen by the ecologically-minded garden owner if he visits such habitats as the sand dunes on the seashore or the mixed deciduous forest. He will note that not only are there great variations in the size, shape and kinds of plants between habitats, but that also in each area the plants are adapted to the environmental conditions. The plant communities may be made up of quite a large number of different species often intermingling in a most attractive and harmonious way.

Usually there is very little bare soil to be seen in such natural areas, so effective is the natural ground cover. There are many other points to be learned from studying plant ecology in the wild, but now it is time to return to the garden, while remembering that the garden site may be looked upon as a small scale habitat or environment and that plant selections may be made on the ecological rules learned from nature.

Garden and Its Site

First, the intimate characteristics of the garden habitat ought to be noted and understood, such as the relationship of the site to buildings, and its climate and microclimate. Apart from the consideration of fundamental genetic hardness of individual plant species, microclimate is of much greater importance than is generally realized. Such effects as turbulence and wind funnels, rain shadows and the effects of tall buildings or trees on the values of light intensity should be noted. A garden usually offers several minor habitats created by such features as north-facing or south-facing walls, dry shaded banks and possibly moist areas near water. Then there are the soil and the existing vegetation, and what designers call the 'genius loci' or inherent aesthetic qualities characteristic of the site.

When making plant selections the objective of an ecological sanctuary should be constantly in mind. One should beware of being deluded by persuasive friends or relations into including kaleidoscopic annuals to 'liven the thing up a bit' or fast-growing trees and shrubs to speed up the screening. These may throw the whole



T. W. J. Wright

Heaths and heathers are excellent ground covers for sunny sites. They can be set about 18 inches apart, in groups of several of one kind and soon carpet the ground.

scheme out of balance and the garden will then become yet another creation of the restless gardener who insists on fighting against nature.

A useful basis for plant selection can be made by following the groups or layers of vegetation described by the ecologist. There are three main layers—the tree layer, the shrub layer and the herb or ground layer. All these may be found associated together, particularly where the tree canopy is not too dense.

Trees need careful selection for the smaller garden. Apart from the adaptability to the site, which may include resistance to pollution and turbulent winds, the tree obviously must be of moderate eventual height with a light canopy and restricted root run. Where insects are not troublesome, European white birch (*Betula pendula*) and thornless honey locust (*Gleditsia triacanthos inermis*), both in their many horticultural forms, are candidates for the garden because they leave reasonable light and allow shrub and herb layers to grow satisfactorily under their elegant foliage.

For the shrub layer, the possibilities are enormous. However, selection criteria must be strict. Shrubs with moderate or slow growth and complete reliability are essential, possessing a tolerance of massing with others without antagonism. Foliage and habit are invariably far more important than the flowers or fruits, which are usually very temporary in their effect. Shrubs may be used to create bold masses for background or screening, for structural division of the garden and for ground cover, particularly on slopes or beneath trees and other difficult sites. Close planting is advised unless single specimens are desired, and distances of 3 to 4 feet apart should be the aim in order to create a 'maquis' effect of intermingling shrubs. Above all, those that need regular pruning or those that have a short life should be avoided. As in nature, the best effect often comes from the grouping of several of the same species or variety. One of each variety in a collection is not following the ecological

rules and will look restless and patchy.

The herbaceous or ground layer is usually far more seasonal in effect since there are many ground-covering herbaceous plants and bulbous species that are spring-flowering before the tree and shrub leaf canopy becomes too dense. However, with careful selection it is possible to choose prostrate-growing shrubs, dwarf conifers and perennials that will form a continuous and harmonious carpet for spreading under and around the trees and shrubs. Bulbs can be planted to come up through the carpet.

A word of caution on selecting and using ground cover plants—some are extremely vigorous, overpowering and invasive. Others may become too tall or unsightly unless really prostrate kinds are selected. Some weeds can force their way through the ground cover and become dominant. Maintenance in the ecological garden will be a regulation of the plant communities, to prevent one section dominating another. Carefully planned groupings can reduce such maintenance.

No mention has been made of rose gardens, herbaceous borders and rock gardens. These are essentially of garden origin and are designed to group together similar types of vegetation for seasonal and decorative effects. The features themselves as such should not really have a place in an ecological garden since other considerations apart, they are labor consuming and have a relatively short period of effectiveness. Many of the plants, however, can be fitted into the vegetation layers. Some roses and certain perennials can be associated with shrubs, and many alpinists in the right soil mixture make excellent ground covers. Annuals in such a garden might best be reserved for tubs or containers near the house.

These, then, are the guidelines for the ecological garden sanctuary. Many landscape architects are now following the same or similar principles, and readers interested in urban planning and plant ecology may wish to turn to Ian McHarg's thought-provoking book *Design With Nature* (see page 60). ♦

The American Chestnut—1971

An interview with Richard A. Jaynes of the Connecticut Agricultural Experiment Station

1. *Is the blight that has ravaged the American chestnut (*Castanea dentata*) caused by an insect or a fungus?*

Chestnut blight is a disease caused by the fungus *Endothia parasitica*. It is spread by microscopic spores that can be carried by animals, such as birds, or by the wind.

2. *How deadly is it?*

It is one of the most catastrophic plant diseases known to man. The blight spread through the native stands of the American chestnut at a rate of about 20 miles per year, completely decimating these large timber trees from Maine to Alabama by 1940.

3. *When and how was it introduced to America?*

The disease was introduced in the late 1800's from the Orient, probably arriving on plants of Japanese chestnut (*C. crenata*) shipped to New York City.

4. *One sometimes still sees sprouts of chestnut trees in rural areas. They seem to get to a certain size, then die back to the ground, and new ones grow in their place. Is this because the blight is slower to attack the root system than other parts of the tree?*

The disease does not normally attack the roots. The spores germinate in a wound or fissure in the bark of the trunk or a branch. As the fungus grows, it forms a localized canker and eventually girdles the stem. As older sprouts become girdled and killed, new sprouts are produced at ground level. Thus, many of the majestic trees of the 1800's were not really killed, but reduced to shrubs.

5. *Are trees sometimes found in the wild that are resistant to the blight?*

Sprouts of the American chestnut have

attained a height of 40 to 50 feet and occasionally a trunk diameter of 12 inches when measured $4\frac{1}{2}$ feet from the ground, but so far none of these trees has been shown to have high resistance to the blight fungus. Infection occurs at random and these large trees are escapes or derelicts that have been infected but not yet succumbed.

6. *Are there still trees that set viable seed?*

As a rule, isolated flowering chestnut trees are sterile, but we do know of native chestnut sprouts that regularly produce fruit. Seed on such sprouts is sometimes fertile (filled), but usually only if there are two clones in flower or cultivated Oriental chestnut trees nearby for cross fertilization.

7. *As time goes by, is it likely that the American chestnut will develop a natural resistance to the blight and that the tree will someday regain a role in the American woodlands?*

Plants do not have an antibody system as found in animals and hence do not develop immunity. It is unlikely that field resistance will be found within the American chestnut. However, there is a remote possibility of obtaining resistance by natural or irradiation-induced mutation. There are others, more optimistic than I, who are working on this possibility.

8. *Why was the decline of the American chestnut a particularly important one?*

The American chestnut was the most valuable tree species in our eastern forests. The wood was resistant to decay and had a variety of uses, including the construction of utility poles and railroad ties; the nuts were a staple in the diets of turkeys, pheasants, squirrels, ducks and



R. Johnson: Crab Orchard
National Wildlife Refuge

This 'Clapper' U.S.D.A. hybrid chestnut is 24 years old and 66 feet tall.

deer; and the bark was the primary source of tannin for the leather industry. Also, it was an important shade tree in cities and on farms. Like the pig and his squeal, everything except the rustle of the leaves was used, and I guess even poets used that!

9. *Are there still unaffected trees—planted in isolation outside of the original range of the American chestnut?*

Yes, large trees are known in several of the mid-western and West Coast states. The scattered nature of these trees and the prevailing westerly winds limit spread of the blight fungus in these areas.

10. *What is the chestnut tree most often planted today?*

Chinese chestnut (*C. mollissima*) is the most commonly planted species. It is blight resistant and forms a spreading or globe-shaped tree that attains a mature height of about 40 feet.

11. *How do the nuts differ from the American chestnut?*

Chinese chestnuts are sweeter than the imported European ones, but not as sweet as the smaller American chestnut. Several cultivars have been selected for abundant production of large nuts, such as 'Nanking' 'Crane' and 'Orrin.' These named selections are not generally available, but seedlings may be purchased from many mail order nurseries (see Brooklyn Botanic Garden Handbook No. 63, 1200 TREES AND SHRUBS—WHERE TO BUY THEM). There are commercial chestnut orchards in Maryland and Georgia.

12. *Is the shrubby Allegheny chinkapin (*C. pumila*) of the eastern U.S. resistant to the blight?*

No, but because it is multi-stemmed and bears nuts at an early age—3rd or 4th year—the disease is less noticeable. The older infected stems can be removed without irreparable loss to the shrub. The chinkapin is a nice yard plant and the small, abundantly produced nuts are prized by birds and other wildlife.

13. *What chestnut is the one commonly encountered in markets?*

The European chestnut (*C. sativa*). Unfortunately, when grown here, it proves not to be as winter-hardy as the Chinese chestnut and it is highly susceptible to the blight. The blight is now at work in European orchards. Researchers in France, Spain and Italy apparently feel that they can obtain necessary disease resistance within the European chestnut.

14. *How many species of chestnut are there in the world?*

Thirteen. They range from forest trees to small shrubs, and are highly variable in other traits, including disease resistance. There may be as few as 15 nuts to the pound of the largest Japanese or European chestnuts or as many as 200 of the small chinkapin nuts to a pound. These edible chestnuts—the true ones—should not be confused with the unpalatable horse-chestnut (*Aesculus hippocastanum*), the so-called “chestnuts” of Paris, which are in quite another plant family. The horse-chestnut leaf is composed of five or more palmately arranged leaflets as distinguished from the simple chestnut leaf.

15. *Have some of these species entered into a breeding program for blight-resistant trees?*

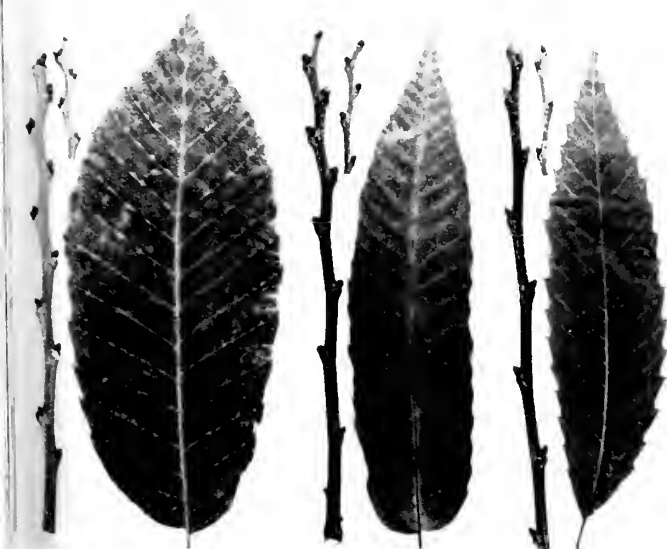
The Chinese and Japanese chestnuts have been extensively used in hybridizing. The aim has been to develop trees with desirable traits for ornamental, wild-life, orchard and forest plantings by combining the most valuable characteristics of different species.

16. *Where is this research taking place today?*

At the Connecticut Agricultural Experiment Station in New Haven. In fact, the program had its beginnings in 1929 under the late Arthur H. Graves, who headed the adult instruction program at the Brooklyn Botanic Garden for many years. Upon his retirement from the Garden in 1947, Dr. Graves devoted his full energies to chestnut research at the Experiment Station.

17. *Have individual trees been selected for their blight resistance and other characteristics?*

Several hybrids have been selected and given numbers or actually named. ‘Sleeping Giant,’ ‘Essate-Jap,’ ‘Clapper’ and C9 are four such clones of special promise



Left: Chinese chestnut. Winter twig color is light; leaf is broad. Center: Japanese chestnut has rounded buds and narrow leaf. Right: American chestnut. Base of leaf blade is angular as compared to two Oriental chestnuts and leaf margin is more dentate. Size of leaf varies and is not critical in identification.



Above: The 'Eaton' Chinese hybrid chestnut at 19 years. Below: Fruit of 'Eaton' as burrs begin to split in fall. This tree has produced between 35 and 50 pounds of nuts in each of the past three years.

chosen for their nut bearing, form, or vigor, as well as for blight resistance.

18. *Has there been any difficulty in propagating these trees by vegetative means (e.g. grafting, cuttings)?*

Vegetative propagation of chestnut has presented serious problems. Several techniques have shown promise experimentally, but as yet none have been perfected for routine commercial production. Grafting, including nut grafting, and rooting of dormant or greenwood cuttings have all been tried with varying degrees of success. One of the major obstacles with grafting is incompatibility. Another propagation method used with some success in Europe is stooling, a process in which a selected tree is cut nearly to the ground in the very early spring and then mounded with soil to encourage new sprouts to root. These may eventually be severed from the stump to form new trees. Persistent testing and refinement of propagation techniques will someday give us a satisfactory method.

19. *In view of the difficulty with vegetative propagation, what is the chance of developing seed strains that are resistant to blight?*

They are a possibility, but because of self-sterility several generations of controlled crosses and selection would be needed. Some progress has been made in this direction.

20. *What are some of the areas of possible future research with hybrid chestnuts?*

We still need a good method of screening young seedlings for resistance to chestnut blight. The fungus can be grown in sterile culture and trees inoculated, but reaction of seedlings to inoculations is not always the same as to natural infection. Research on breeding, selection and propagation should be continued. Recent studies indicate that systemic fungicides (benomyl or Benlate) may arrest growth of the blight fungus. More research is needed to test the value of such materials.

21. *Are you optimistic about the future of hybrid chestnut trees?*

Yes, there is no doubt in my mind of the present value of chestnut as an orchard tree, as a source of food for wildlife, and as an ornamental. With better selections and improved propagation techniques, the use of chestnut in at least limited forest plantings is a real possibility. Public interest in chestnut research continues at a high level. A notable recent example of private initiative and financial support has resulted in the Experiment Station's participation with the Virginia Division of Forestry in a large experimental planting of hybrid chestnuts (10,000 trees) in Nelson County, Virginia. Progress on tree research is slow, but as a result of the early efforts of men like Arthur Graves and Russell Clapper (USDA breeder), and continuing support by the state of Connecticut, encouraging progress has been made.

22. *Is there any organization a gardener might join to learn more about nut trees?*

Yes, the Northern Nut Growers Association, Inc., whose members include professional horticulturists and farmers as well as hobbyists and home gardeners. It publishes a quarterly bulletin, THE NUTSHELL, in addition to a yearly report, which is based on the proceedings of the annual meeting. The meetings are usually held in the middle of summer. Dues are \$5.00 per year, payable to the Association, and should be addressed to William S. Clarke, Jr., Treasurer, Box 805, State College, Pa. 16801.

Dr. Jaynes edited the *Handbook of North American Nut Trees*, published in 1969 by the Northern Nut Growers Association. It is available for \$7.50 (\$9.00 overseas) from Association headquarters at 4518 Holston Hills Rd., Knoxville, Tenn. 37914. This 421-page book, which has contributions from 25 specialists in the field, contains valuable information on cultural practices, propagation and breeding, as well as descriptions of many nut trees and their cultivated varieties.

A Marriage is Arranged

—probably the oldest “bride” ever shipped to America

George S. Avery

THE Brooklyn Botanic Garden recently added another prestigious bonsai to its already notable collections. Like most of the other high ranking specimens in the Holsten and Phipps Collections, it came from the Kyukaen Nursery (Nursery of the Nine Mists) of Mr. Kyuzo Murata in Omiyo, Saitama Prefecture, Japan.

The newly acquired bonsai was first seen by Botanic Garden representatives in November, 1969, when a tour group of garden members visited Japan. Three special events were scheduled for the first few days in or near Tokyo. The first was a joint dinner meeting at International House with members of the International Rock Appreciation Club (Tokyo Chapter), under the Presidency of Dr. Shunji Ito; the second was a special invitation visit to the private garden and bonsai collection of President Sato of the Tokyo Sash Company—where our group was warmly greeted by Mrs. Sato. Last—but in the light of subsequent events the most important event of all—was a visit to the bonsai nursery of Mr. Murata.

After admiring many of the trees available for purchase, two members of our group kept wandering back to look at a gnarled and twisted ‘old timer,’ a *shimpaku* (Sargent juniper). To see it was to read at a glance its autobiography—lonely centuries of a frugal existence in an out-of-the-way mountainous region somewhere in Japan, buffeted by continuous winds and winter storms—but always with the strength to survive.

Mrs. Emmet J. McCormack is the tour member whose gift made possible its ultimate purchase. As a Brooklyn Botanic Garden Trustee she has long admired and appreciated fine bonsai. A few days after the visit to Mr. Murata's Nursery of the Nine Mists, and while the tour party was still based in Tokyo, Mrs. McCormack said

one evening, “I think the ‘old timer’ we admired so much the other day ought to be in the Botanic Garden's bonsai collection and, if you agree, I would like to give it.” This generous suggestion was not lightly taken and through a Japanese friend we telephoned Mr. Murata the next morning, reporting probable interest in acquiring his tree for the Botanic Garden. He was noncommittal but said he would mail a photograph of the tree to reach us after our return to the United States.

Came December and the photograph arrived. A letter was promptly dispatched from the Botanic Garden to Mr. Murata, accompanied by a purchase order for the tree. No acknowledgment was received, so in the ensuing weeks other letters were written. It seemed that we had failed (or were failing) to convince Mr. Murata that the tree should come to make its life in America and, knowing that he did not read English, it occurred to us that the translation of our letters might not be conveying the deep feeling that we had for his magnificent bonsai.

With this in mind we turned to a personal friend of many years—and friend of the Botanic Garden's in Japan Dr. Tomoya Funahashi, distinguished Professor of Ophthalmology at the Jikei University Medical School in Tokyo, could surely help. His splendid knowledge of the English language would insure a sensitive and adequate translation of our wish to acquire the bonsai. Thus, another letter was dispatched to Japan, this time through Dr. Funahashi. No reply. The another letter.

In early July, 1970, a beautiful letter arrived from Mr. Murata. It included here because it has so many classic qualities that relate to the history of the tree as well as to Mr. Murata himself—and a difficult decision regarding the sale of the tree. As a sensitive and gifted bonsai

artist, yet in the nursery trade, ought he to let this unique tree leave Japan? Only the last two brief paragraphs of Mr. Murata's letter regarding business arrangements are omitted, and we are indebted to our good friend here in New York, Mr. Mike Miyano, for his translation.

Kyuzo Murata
Kyukaen

June 26, 1970

Dear Dr. Avery,

Please accept my sincere apology for not writing you sooner. I have recently received a translation of your letter from Dr. Funahashi. Although I have had every intention of writing you since February, I have never been so busy in my life. I have had to travel to Osaka several times to set up the Bonsai Show exhibit at EXPO 70.

When you visited me last fall with your members I sensed that the shimpaku might have to go to America, so later I arranged with a local photographer to take several pictures of it. At that time I told him unwittingly that the tree might go to America. The photographer in turn mentioned this to someone here in town. Then many people started to inquire whether the rumor could be true; some people even accused me of making the same mistake as was made with many fine Ukiyoke (woodblock prints) that were sold to Americans right after the war. A fellow bonsai nurseryman here in Omiya also tried to stop me and asked me to keep the tree. It took a long time and was an effort for me to express my own opinion about it to the many people who expressed concern. Finally I persuaded them to agree with me. My thoughts, as expressed to them, were as follows.

Personally, I do wish to keep this fine tree in my private collection as long as I live, but since I am in the trade I am willing to sell it only if some vital qualifications are met. Recently, air pollution in Japan is becoming unbearable for both human beings and especially for trees in the garden. The pollution is caused mostly by motor cars. I am not against prog-

ress, but trees do not understand it. They just have to suffer and sometime die quietly. I have been told that Brooklyn Botanic Garden is large enough that it cannot possibly have a pollution problem within its premises. There is no place in America like the Brooklyn Botanic Garden where all necessary facilities are available for proper care. Above all it is highly important that American people, most of whom are still relatively strange to our fine art of bonsai, will have a chance to appreciate the tree.

These were a few of my many reasons, and at the end everyone understood. I have said to my friends that I would not sell it even for a million dollars, if Brooklyn Botanic Garden were a commercial nursery, but I know B.B.G. staff would love and care for my tree, not just professionally, but wholeheartedly. Anyway, it is all right now and I feel as if I am giving my own daughter to an American to be married.



Sargent juniper (*Juniperus chinensis sargentii*) recently acquired by Brooklyn Botanic Garden from the nursery of Mr. Kyuzo Murata, in Japan. Estimated age: 600 to 1000 years; 3 feet in height. Its nickname in Japanese is "Fudo."

The Shimpaku is considered to be between 600 and 1000 years old; I am sure you will know a scientific way of measuring how old the tree really is. If you can find out, would you please let me know as I myself wish very much to know? I am most certain that this tree is one of the oldest being used as a bonsai plant in Japan and I don't believe we will ever have a chance to come across anything like this one again. I am not sure how old is the art of bousai in our country, but it is at least 500 years since the idea of pot-grown trees was imported from China and somehow improved by Japanese.

Many Japanese have loved bousai and cared for them through many generations, but usually a tree can be loved and cherished for only a couple of generations. A son does not necessarily share the hobby or taste of his father, so after a while (meaning about 50 years time) a young but potentially good bousai tree simply fades away by not being properly taken care of. It is very rare that a tree survives for many generations, except in the Collection of our Imperial Household where one can see many trees as old as 200 to 400 years. A tree must be loved and cared for constantly. If only a single owner among the many generations of its life fails, then that will be the end of the tree.

In Japan, many high government officials have owned bonsai, but there have been very few who deeply appreciated the value of their fine trees, and very few who have cared for them with their own hands; they are mostly given to them as gifts or purchased, mainly to satisfy social vanity.

Last year our Government decided to build a Japanese Pavilion at EXPO with traditional Japanese arts and gardens . . . then they could not help but realize the importance of the art of bonsai. They summoned me to do the job and allocated about \$100,000 for the Japanese Bonsai Association to set up about 250 fine bonsai to be exhibited in the Pavilion. Prior to the opening, our Crown Prince visited us with his Princess, and Prime

Minister Sato was a recent visitor. They were all pleased to see our trees.

The subject of my negotiation with you is the Shimpaku with the nickname "Fudo," which made its first public appearance during the All Japan Bonsai Exhibition in Tokyo's Shiba Park Art Club. This was in April, 1929. It received the first prize and vanished. At that time the owner was Mr. Chutaro Nakano, a Japanese oil magnate, and that was Fudo's first and last appearance. Mr. Nakano was afraid that exhibitions might spoil the tree and he built a special place for Fudo deep inside his mansion in Niigata. Fudo did not again appear in public until 1946. People who remembered the Shiba Exhibition called it the "Phantom Shimpaku."

Fudo was said to have been found by Mr. Tahei Suzuki, the famous bonsai tree hunter of our time. It was he who was credited with discoveries of such famous trees as Tsurunomai (Dance of a Crane), Shiraito Falls and Hou-ou (Phoenix). Fudo was reportedly found during the year 1910, somewhere in the upstream area of the Itoi River near the Japan Alps, in Niigata Prefecture. No one knows the details, as Mr. Suzuki passed away in 1925. The first wiring was performed by Mr. Kinsaku Saido, number one wiring master of all time.

The Fudo survived the war and finally was bought in 1946 by Mr. Yoshimatsu Hattori of Kiryu City, Gumma Prefecture—where the tree first received the name of Fudo. The name comes from the "God of Fire Fudo," imaginary guard of the Buddha against all evils, standing amid flames without moving. The Fudo's appearance suggests swirling flames. Mr. Hattori was also reluctant to show the Fudo in public. He died in 1960 and all of his collection was for sale except the Fudo, which was taken by his son Osamu. Although Osamu was not keen about bonsai, it took me several years to persuade him to sell it to me. It was the summer of 1969 that Fudo came to me at Kyukaen. As you see, not many people have actually seen the Fudo except in a picture.

Fudo is doing fine now and is as healthy as ever, but I cannot possibly ship her in sea cargo as it might take a month or more to get to Brooklyn Botanic Garden. If I am to send her by air it would probably cost about \$400 as compared to \$150 by sea; I will get the exact air fare from Pan American or Japan Air Lines and let you know. I earnestly wish my Fudo to travel by air; it is just too cruel to think of her traveling a month or two in the dark bottom of a cargo ship to her wedding. . . .

Good health to you all.

(Signed) Kyuzo Murata

Fudo arrived in New York on Monday, October 19, 1970 via Pan American Airways and was officially met at Kennedy International Airport by Mr. Robert S. Tomson, Assistant Director of the Botanic Garden, together with representatives of the U.S. Department of Agriculture.

The prescribed fumigation treatment was carried out and Fudo is now on display at the Botanic Garden in a screened quarantine cage—where she will remain until released by the Plant Quarantine Division of the Department of Agriculture. This hardly seems a fitting wedding reception for so distinguished a bride, yet it complies with plant importation law and is a justifiable precaution against the introduction of plant pests which, though perhaps no problem in their original homeland, might be difficult or impossible to control if they were to escape in a new environment.

We pray that Fudo will understand the reason for her matrimonial incarceration. ♦

For information and instructions regarding the importation of bonsai from Japan, write the Plant Quarantine Division of the Agricultural Research Service, 209 River Street, Hoboken, New Jersey 07030.



Part of the Garden's bonsai collection, to which Fudo is a treasured addition.

What causes a lake to become a marsh?

Our Changing Lakes

Warren P. Balgooyen

EUTROPHIC, eutrophication, eutrophism—this strange family of words has come into popular use during the last decade on the coat-tails of the now dynamic science of ecology.

Once the jargon of obscure technical journals, these words, applied to lakes and ponds, are now used almost daily in many households. The popularization of these terms indicates that people are becoming aware of man-caused environmental changes and are concerned enough to master their meanings.

Eutrophie, of Greek derivation, means "rich in life" (literally, eu = "good" or "advantageous;" -trophie = "nursing," pertaining to nutrition). Like everything else in nature, lakes have a life span. As they age, they become increasingly eutrophic—rich in plant and animal life. The degree or rate of eutrophism depends on the surrounding environment and man's influence on it.

Eutrophism is caused by the addition of fertilizer to a lake from outside sources; ecologists call it outside nutrient import. In a wilderness situation the import of nutrients from a lake's watershed is very small. A heavy forest cover slows down runoff and enables terrestrial vegetation to utilize those few nutrients that may be released in the environment.

In an area extensively settled by man runoff is rapid. Nutrient-laden waters are not held in check, although the land receives many times more nutrients than does a wilderness watershed. Man contributes these extra nutrients via high phosphate detergents and indiscriminate use of lawn fertilizers. Other sources include farm wastes and the leaching out of soil nutrients from plowed or bulldozed land. Another factor in eutrophication—overflow from septic tanks with inadequate or faulty drainage.

Fertilizing a lake may be compared with fertilizing a lawn or garden. The result in both cases is more rapid plant growth and increased yield. If a very large amount of fertilizer is applied to a lawn, the grass may "burn" or even die. However, the cause of a lake's death is more indirect. Lake Erie, for example, is so overburdened with fertilizer that there are now more plankton, algae and higher plant life than the lake can accommodate. As the organisms die, their decomposition decreases the available oxygen, and aquatic plants, like land plants, require oxygen to function.

While few lakes have had an overdose of fertilizer comparable to Lake Erie, the addition of lesser amounts increases the yield of plant life, accelerates eutrophism, and leads to their eventual demise. Each year plant remains settle to the bottom. This material decomposes over a period of time and consumes so much oxygen that very little is left for the fish. Not all material decomposes at the same rate, and the parts which are slower to break down contribute noticeably to making the lake more shallow. The more plants there are in a lake, the faster it will fill in.

Eventually, lakes can become marshes through the deposition of plant and animal remains, sand and silt. A lake's life cycle may be sped up from a wilderness norm of, say, 10,000 years to the point where a very real progression toward a marsh may be observed in a human lifetime. Can or should something be done to reverse this process? Most of us would agree that advancing mats of vegetation are unattractive. They also restrict boating, fishing and swimming. But one may question whether it is always wise to interfere with a natural, albeit man-accelerated, process of change from lake



Children explore Tectown Lake whose weedy areas harbor vast treasure.

to marsh. Marshes, too, are of value in providing food and habitat for wildlife.

The process of eutrophication can be arrested but not easily reversed. It cannot be reversed while pollution of lakes continues. To stop such pollution, people must be willing to forego high phosphate detergents, to restrict their use of commercial fertilizers and to maintain the efficiency of their sewage systems.

While attacking the problem at its source is a good approach, it will not provide an immediate relief to the problem of eutrophication. It takes many, many years for a lake to purge itself of excess nutrients.

The Brooklyn Botanic Garden's Teatown Lake near Ossining, New York, illustrates some of the problems of eutrophication. The process has accelerated to such a point that restoring the lake now would be loosely similar to restoring a forest after it has been burned over. It could be done, but not without close community cooperation, a considerable amount of time, and much money.

Control of weeds can be accomplished mechanically or chemically. Both methods have their good and bad points. Mechanical control—cutting or pulling the vegetation—is desirable because the plants can be harvested and removed from the lake. This helps to deplete the lake of its excess nutrients. The weeds contain nutrients which will only be recycled if they remain in the lake to decompose. However, dealing with the growth mechanically in a lake of any size is nearly as frustrating as mowing a lawn with a razor blade! Underwater weed cutting was tried at Teatown Lake with specially designed equipment. Even so, regrowth was so fast that the project had to be abandoned.

Chemical control, the other alternative, saves time and labor. However, the dead weeds and their nutrients remain in the lake to be recycled. Also, cost is often prohibitive. In a lake with an average depth of 4 feet, application of a standard aquatic herbicide at recommended dosage costs about \$100 per acre. For example, to treat the 33 acres of Teatown Lake, which is less than 4 feet deep in many

spots, would cost from \$1,500 to \$3,000, depending on the chemical used. Applications should be repeated each year to be effective, and it has even been suggested that two applications be made in a year. Such an expenditure, for a measure that is only temporary, is beyond many budgets. Copper sulfate, while much less expensive, will kill only algae. It will not directly affect higher plant life such as milfoil (*Myriophyllum*) and waterweed (*Elodea*).

Ecological effects must also be considered. Adding chemicals in any amount to an aquatic environment is a risky procedure, and to apply a herbicide at a level which is both effective and recommended is frequently difficult. Even when accomplished, a drastic reduction of plankton and invertebrate life is unavoidable. The base of the food chain is altered, with widespread repercussions for different organisms. A lake is a food "factory" for many kinds of wildlife in its vicinity.

When one considers the economic and ecological risks to the control of aquatic weeds, one must ask—is it worth it? Unless the gradual loss of a lake's recreational value conflicts with one's particular interests, money might be better spent on pollution abatement than on weed control. At Teatown Lake, for example, recreation is not considered as important as environmental education and wildlife preservation. In its present condition the lake is extremely rich in animal life and well suited to pond life studies. Because of the lake's sheltering weeds, an exploring child, with one scoop of a net, can obtain a wide variety of living organisms. On the other hand, a lake valued for boating and swimming is not of much benefit when it is choked with weeds.

No two lakes, of course, are alike. What is good for one may not be good for another. It should be recognized, however, that eutrophism of itself is not necessarily detrimental. Whether aquatic weeds should be controlled depends on the intended use of the lake and, most important of all, the degree of eutrophism.

Aloe vera—a house plant which will heal
minor skin burns and blemishes . . .

A Cosmetic From A House Plant

Ralph Holt Cheney

SEVERAL PLANTS have provided man with some of the most effective drugs in modern medicine. One of the best known is purple foxglove (*Digitalis purpurea*), compounds of which are used to control certain heart action irregularities. Penicillin and other antibiotics, also an integral part of modern medicine, are derived mostly from soil bacteria and fungi. In recent years one plant that has received considerable attention from layman and physician alike is *Aloe vera* (known to botanists as *A. barbadensis*), used in the treatment of burns, X-ray overexposures, eczema and other skin irritations. While new investigations are still needed to discover the detailed chemical constituents of this aloe and to determine the individual pharmacologic action responsible for their apparent efficiency, *Aloe vera*, sometimes called simply "medicine plant," has become a common pot plant in kitchens.

The medicinal use of various kinds of *Aloe* (there are about 170 species) is not new. In fact, as early as the fourth century B.C., under the name of "mussa-bar," *Aloe vera* was employed for inflamed, painful parts of the body. Over the years there have been many other reports, and *Aloe vera* itself has become part of medical folklore. Its external use for pathological skin abnormalities has always been emphasized as possessing remarkable therapeutic value. While this species is thought to be native to the Mediterranean region, it is also known in China as "jelly leeks" and has been used medicinally in that country as well as in the West. Readers interested in the folk-

lore uses and commercial exploitation of *Aloe vera* may wish to turn to Julia F. Morton's article (1961) in "Economic Botany" (Vol. 15, No. 4:311-319).

Frequent inquiries come to the Brooklyn Botanic Garden requesting information about the value of *Aloe vera* in cosmetic preparations. I cannot vouch at present for the efficacy of any individual preparation other than the fresh juice. In Florida, however, there are several such items produced and marketed in attractive plastic jars and bottles.

Fresh leaf juice of *Aloe vera* contains the drug aloin (barbaloin). When the thick fleshy leaves are cut, the juice oozes readily from the interior. As an aid in soothing kitchen burns, it must be applied fresh in order to alleviate discomfort most effectively and to hasten the healing process. An application of the juice lasts only a few hours. The juice, light greenish-yellow at first, acts chemically and



Aloe vera

An article by Dr. Cheney on "Aloe Drug in Human Therapy" appeared in *Quarterly Journal of Crude Drug Research*, Vol. X (1970), No. 1, pp. 1523-1530.

quickly forms a protective coating. It darkens as a gummy mass within a brief period and can be washed off easily with warm water. Fresh applications can be made as needed. No record exists of *Aloe vera* being harmful to skin surfaces, but for skin disorders or burns other than of a minor kitchen nature, it is of course wise to consult a physician.

Aloe vera is a member of the lily family and should not be confused with the so-called American aloe or century plant (*Agave americana*) which, although also a succulent, belongs to the amaryllis family. *Aloe vera* is a perennial with strap-like leaves that are grayish-green with white spots while young. Its eventual height: 1½ feet. The yellow flowers are produced only infrequently. The plant can be cultivated easily in the garden in

frost-free climates, or as a house plant. Best growth occurs in light shade, and the only difficulties likely to be encountered by home gardeners are over-watering and poor drainage. If *Aloe vera* is grown in a pot, provide ample drainage material such as coarse pebbles at the bottom and incorporate a liberal amount of sand in the soil mixture. The plant propagates readily by offsets.

Editor's Note: Some U.S. mail-order sources for *Aloe vera* are: Logee's Greenhouses, Danielson, Connecticut 06239; Merry Gardens, Camden, Maine 04843; George W. Park Seed Company, Greenwood, South Carolina 29646. Those who wish to experiment with beauty aids containing *Aloe vera* will find them listed in the mail-order catalog of Star-Dee Health Products, Island Park, N.Y. 11538. ♦

An Outstanding Ground-cover Shrub

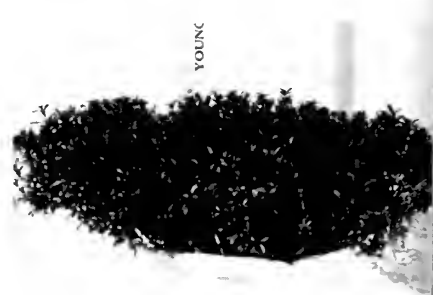
QUITE by accident a number of years ago, a rotary mower (set high for long grass) was pushed over a few plants of Kingsville dwarf boxwood (*Buxus microphylla* 'Compacta'). **Time of year:** mid-May. **Place:** eastern Connecticut. **Result four weeks later:** height of the plants reduced to about 3½ inches, with the new foliage denser than ever and almost velvety in appearance. **Conclusion:** mowing dwarf boxwood can produce a unique and attractive ground cover. **Caution:** mow *only* early in the season, so the plants will soon recover from their

drastic machine-pruning; if mowed ever second year, they grow to a height of 6 or 6 inches between mowings. **Landscaping uses:** many, but can be effectively employed as a low border planting, one plant wide. **Maintenance time:** virtually none as compared with hand shearing; uniform height insured.

A variation on this theme is suggested by Russell Page in *The Education of a Gardener* (New York: 1962). He describes how low-clipped boxwood may be used "checkerboard" patterns to break the monotony of a large terrace. ♦



A single dwarf boxwood plant, 15 inches high and never mowed.



A single plant, mowed early May, 1966, and photographed in the fall of 1967.

How Large Nurseries Select New Trees

Push-button selection of shade trees may not be an impossible dream!

William H. Collins

TODAY as house lots become smaller, there is a special need for trees that will "fit" the space. Tomorrow, many of the fine large-growing trees gardeners are now familiar with will lose favor in the home landscape and be replaced by ones of modest eventual height and branch spread. Some of these trees will be columnar, while others will be specially selected to grow—and mature—under utility lines. Still others will be chosen to provide acceptable shade for a terrace or picnic table and yet permit enough light to pass through to allow lawn, shrubs and flowers to thrive. A number of such special-purpose trees have been selected in the last 25 to 50 years and are available as stepped-up programs by nurserymen, governmental agencies and arboreta bear fruit.

Tree selection by nurserymen has continually been refined to meet the needs of contemporary life. Early shade tree selection generally involved only the elimination of the poorest seedlings. In contrast, modern tree selection involves saving the best few of hundreds or thousands of seedlings of a particular kind. Sometimes, these become the nucleus for a breeding program that will assure superior parent trees. After years of testing and evaluation, the very finest of these will find their way into home plantings.

Many of today's superior trees have resulted from a chance observation in a park, along a highway or within private property. Certain nurserymen have developed a sharp "eye" in picking out such trees for propagation by grafting or budding. Also, our native forests and woods sometimes offer promising trees for selection purposes, but most of these are individually more difficult to see and to evaluate fairly.

The most recent emphasis in tree selection is the result of the very direct way trees visibly react to man's alteration of the environment—air, water and soil pollution. For example, established trees planted along increasingly busy highways react with reduced vigor, distorted or sickly leaves and dead twigs. Air pollution and often a salt-polluted soil may be injuring or killing them. However, among these trees there is an occasional one that shows some tolerance to the conditions existing in such locations. Such trees are now being evaluated for use in areas of urban stress, or they may be used as parent trees in breeding programs. The offspring are likely to have an important role among trees of the future—trees bred to withstand some degree of environmental pollution.

Wholesale nurseries share the burden as well as the responsibility in time, money and personnel to develop and introduce superior trees and shrubs. They are in direct contact with the needs and desires of the market. Similarly, they know, or must determine, if a potentially promising plant can be produced at a competitive and acceptable price.

Nurseries vary in their plant research and development programs. One wholesale firm, the Cole Nursery of Circleville, Ohio has in various stages of testing, evaluation and limited production, special forms of the following woody plants: sugar, red, black maples; white and blue ash; hardy rubber-tree; ginkgo; honey locust, golden-rain tree; sweet gum; flowering crabapple; dawn-redwood or metasequoia; hop-hornbeam; Amur cork-tree (*Phellodendron*); plum; cherry; Callery pear; sawtooth, red and shingle oaks; mountain-ash; little-leaf linden; elm. Shrubs: gray dogwood; autumn-olive; winterberry holly; privet; beach plum;

buckthorn; coralberry; viburnum.

Many other progressive wholesale nurseries are engaged in finding and selecting new varieties. Among those having extensive programs are Monrovia Nursery Co., Azusa, California; Princeton Nurseries, Princeton, New Jersey; Edward H. Scanlon & Associates, Olmsted Falls, Ohio; Schmidt and Son Co., Troutdale, Oregon; The Siebenthaler Company, Dayton, Ohio; and Simpson Orchard Co., Vincennes, Indiana.

The techniques of tree selection differ from nursery to nursery, but a few basic steps are commonly followed by most leading firms. After an apparently superior seedling or mature tree has been discovered or created, buds or grafts of the desirable form are made onto seedling trees of the same species with as little delay as possible, since it is literally one of a kind. Such vegetative propagation is essential, for it is only rarely that the offspring come true from seed.

For a number of years the parent tree and some of its first propagated progeny are observed in order to determine their real superiority. Annual performance records are kept. Also, 35 mm. slides are taken to accurately record flowers, fruit, foliage and form. Such records may be used in the promotion and publicity if introduction becomes a reality.

Then, a stage in testing is reached when a definite commitment is made. Experience usually tells whether a selection is worthy of further study. A determining factor in the tree's introduction to the trade is whether it can be produced competitively within the framework of the propagation and cultural practices currently employed by the nursery.

Nurseries must anticipate the popularity or acceptability of the selected tree. Before commercial production starts, management tries to determine honest answers to questions such as these—Is this plant already well known? Is there really a po-

What to Look for in a New Tree

- Make sure that the tree you select is hardy in your area. A tree need not necessarily be of "ironclad" hardiness for certain purposes, but remember that a test winter will occur every 20 to 25 years. Check with your local nurseryman or county agent if in doubt about a tree's hardiness.
- Look for trees that are pest resistant. Even within a narrow plant group, there are some new cultivars that have been selected because they do not appear susceptible to pests that sometimes attack the group. For example, some kinds of flowering crabapples are outstanding in their resistance to leaf diseases.
- Don't ignore ecology. Make sure the tree is adapted to the site. Will the tree accept the soil type, exposure (wind, sun, etc.) and the area's average rainfall? Will it tolerate inflicted alterations such as soil compaction, overwatering, pets, reflected heat, unnatural pruning?
- Consider whether the tree has a maximum of ornamental qualities—attractive flowers, colorful fruit, autumn color, interesting bark, or even an intriguing winter silhouette; *most important of all*—handsome, long-lasting foliage.
- Is the tree reasonably long lived? If there is a choice between two equally desirable kinds, longevity should determine the choice.
- The particular tree should be well formed structurally so that it can withstand strong winds and moderate sleet and ice storms.
- Remember that certain trees, because of their small leaves, pose much less of a clean-up problem in the autumn than do others. Where low maintenance is essential, selection of such trees can save you work.—W.H.C.



Princeton Nurseries

Little-leaf linden (*Tilia cordata*) has been a popular shade tree since ancient times, but individual trees vary in their attractiveness. One of several recent selections is 'Greenspire', which has small leathery foliage on branches that are arranged radially around a straight trunk. Even young specimens are shapely.



Flowering crabapple 'Snowdrift' growing in rows at Cole Nursery Company grounds. It has large white single flowers.

tential demand? Will it likely be sustained? Will the plant require few or many years in the nursery before it reaches salable sizes? Is the plant difficult to propagate?

Patented Plants

Readers may notice that some of the new trees developed by nurseries bear patent numbers. One main purpose of plant patents is to afford an originator the opportunity to try to recoup costs of development and/or promotion by restricting vegetative propagation to those licensed to do so. Many worthwhile plants never become well known and commercially available simply because of the high costs of promotion. It may cost as much as \$10,000, sometimes more, to introduce and make available a fine new plant.

A plant patent protects its owner from infringement by others for a period of 17 years. For a plant to be patented, it must be proven to be substantially different from others and capable of transmitting these identifiable characteristics to its vegetatively propagated progeny. As a result, it is only the most distinctive and superior plants that are considered for plant patent application. Over the years, slightly more than 3,000 plant patents have been granted by the U.S. Dept. of Commerce. The plant patent process is rather complicated and usually requires

the assistance of a patent lawyer. Two booklets of interest for those seeking preliminary information are *General Information Concerning Patents* and *Questions and Answers About Plant Patents*. Both are available on request from the Commissioner of Patents, Washington, D.C. 20231.

Listed below is a selection of new trees showing the wide variety that is available today. Not all will be "carried in stock," but local nurserymen and garden centers can secure them for you through their wholesale sources. Plant patent numbers are included after the cultivar names.

Norway maple (*Acer platanoides*)

- 'Cleveland.' Upright; rapid growth; dark green leaves.
- 'Emerald Queen.' Rapid growth; dark foliage.
- 'Summershade' (P.P. #1748). Rapid growing; dark foliage.

Red maple (*Acer rubrum*)

- 'Armstrong.' Narrow columnar form; upright branching.
- 'Autumn Flame' (P.P. #2377). Leaves turn scarlet in early fall.
- 'Bowhall.' Upright; columnar to narrowly pyramidal.
- 'Gerling.' Densely branched; oval to pyramidal shape.
- 'October Glory' (P.P. #2116). Late

crimson-red fall color.

'Red Sunset' (Trademark). Bright red fall color, medium-to-late.

'Tilford.' Broadly pyramidal, eventually oval.

Sugar maple (*Acer saccharum*)

'Green Mountain' (P.P. #2339). Thick, waxy leaves resistant to scorch; oval crown.

Eastern redbud (*Cercis canadensis*)

Kinds with white or pink flowers; also a double-flowering form.

'Forest Pansy' (P.P. #2556) has new growth that is bright red, deepening to maroon red as the season progresses.

Flowering dogwood (*Cornus florida*)

'Rainbow' (P.P. #2743). Colorful variegated foliage; distinct.

Other fine new cultivars, some patented.

Hawthorn (*Crataegus*)

'Crimson Cloud' (P.P. #2679). Red flowers, single; fruit red.

'Toba.' Double flowers, at first whitish, then fading pink; disease-resistant. Originated at Dominion Experimental Station, Morden, Manitoba, Canada.

'Vaughn.' Glossy bright red fruit; vigorous hybrid.

'Winter King.' Persistent orange-red fruit; silvery bark.

White ash (*Fraxinus americana*)

'Autumn Purple' (Trademark). Deep purple fall color; seedless.

'Rose Hill' (P.P. #2678). Bronze-red fall color; seedless.

Green ash (*Fraxinus pennsylvanica lanceolata*)

'Marshall's Seedless.' Hardy, fast-growing; shapely crown.

Other ash

'Hessei.' Lustrous leaves; vigorous; round-headed. A selected form of the European ash (*Fraxinus excelsior*).

'Moraine' (P.P. #1768). Medium-sized tree; good form. A cultivar of *F.*

holotricha.

Thornless honey locust (*Gleditsia triacanthos inermis*)

'Green Glory' (P.P. #2786). Leaves retained until late in the season.

'Imperial' (P.P. #1605). Graceful, sturdy; dense branching.

'Majestic' (P.P. #1534). Tall, graceful; spreading habit.

'Moraine.' Fast growth; elm-shaped.

'Ruby Lace' (P.P. #2038). New growth ruby-red, providing contrast.

'Shademaster' (P.P. #1515). Rapid growth; ascending branches.

'Skyline' (P.P. #1619). Stately; pyramidal.

'Sunburst' (P.P. #1313). Leaves on branch tips brilliant golden yellow. Because of this, tree appears to be in flower when seen at a distance.

Ginkgo or maidenhair-tree

(*Ginkgo biloba*)

'Autumn Gold' (Trademark). Staminate or male form. Gold fall color.

'Fairmount.' Staminate, pyramidal.

Sweet gum (*Liquidambar styraciflua*)

'Burgundy' (Trademark). Autumn foliage dark purple. One of several selections made by the Saratoga Horticultural Foundation, Saratoga, California.

Star magnolia (*Magnolia stellata*)

'Royal Star.' Larger flowers than usual for the species.

Flowering crabapples (*Malus*)

'American Beauty' (P.P. #2821). Flowers red, double.

'Coralburst' (P.P. #2983). Double, rose-pink; dainty.

'Pink Perfection' (P.P. #2912). Double, pink.

'Pink Spires.' Upright, pyramidal. Reddish foliage and rosy pink flowers. Similar to 'Strathmore,' but better.

'Red Jade' (P.P. #1497). Best weeping form. Originated at the Brooklyn Botanic Garden.

'Royalty.' Flowers crimson, almost purple. Leaves red in spring, later dark greenish-purple.

'Royal Ruby' (Patent applied for). Large double red flowers.

'Snow Cloud' (P.P. #2913). White, double.

'Snowdrift.' Large single white.

'White Angel' (Trademark). Single white.

'White Candle.' Semi-double, white. Columnar.

This list is just a sampling of the many new crabapples available.

Flowering pear (*Pyrus calleryana*)

'Bradford.' White flowers; tiny fruit; glossy leaves. A selection named by the U. S. Dept. of Agriculture.

'Chanticleer' (P.P. #2489). Symmetrical; cone-shaped.

Dwarf or Korean (var. *faurei*). Round-headed. Matures at about 15 ft.

Pin oak (*Quercus palustris*)

'Sovereign' (P.P. #2662). Branches upright, including lower ones. Symmet-

rical.

Pagoda-tree, scholar-tree (*Sophora japonica*)

'Regent' (P.P. #2338). Dark green foliage, white flowers.

European mountain-ash (*Sorbus aucuparia*)

'Cardinal' (Patent pending). Vigorous; upright growth; red berries.

'Cole's Columnar.' Upright habit; abundant fruit.

Little-leaf linden (*Tilia cordata*)

'Chancellor' (P.P. #2712). Dark green foliage; upright habit.

'Greenspire' (P.P. #2086). Rapid growth; shapely head.

'Rancho' (P.P. #2092). Upright habit; conical outline.

Other lindens

'Redmond' (cultivar of *Tilia euchlora*). Pyramidal; hardy.

Japanese zelkova (*Zelkova serrata*)

'Village Green' (P.P. #2337). Straight trunk; uniform branching.



Rows of budded selections of black *Acer platanoides* in the Cole Nursery fields

A strikingly beautiful flowering tree for mild climates . . .

The Powder-Puff Tree

Lorin I. Nevling, Jr. and Thomas S. Elias

THE POWDER-PUFF TREE (*Calliandra haematocephala* Hassk.) is a tropical or subtropical member of the legume family, usually seen as a small tree with a broad spreading crown. The flowers are densely clustered into bright red globose heads, suggesting the origin of the common name, powder-puff tree. While the calyx and corolla of the flowers are white to greenish, the staminal filaments are red and provide the overall color of the inflorescences. The bright green, bi-pinnately compound leaves furnish additional ornamental interest.

The powder-puff tree is native to the lower mountain slopes and river valleys of western Bolivia. It is thought that all plants under cultivation originated from two introductions some 68 years apart. The first introduction resulted from a mission, 1853-1854, supported and organized by the Dutch Minister of Colonies. The purpose was to secure living plants of *Cinchona* (used for malaria control) so that plantations could be established in the Dutch colony of Java. Justus Charles Hasskarl was sent to Bolivia on this secret expedition to obtain the *Cinchona* and, while engaged in this project, probably obtained seeds or plants of many other native species, including *Calliandra haematocephala*. After his return to Java, he described the plant as new to science, but possibly because of the secret nature of the trip he attributed the source of the plant to the botanic garden at Calcutta. No record is available from Calcutta, and his narrow-leaved form of the powder-puff tree was believed by later workers to be of unknown origin.

A detailed account of the history, morphology and taxonomy of *Calliandra haematocephala* by Drs. Nevling and Elias appeared in the January 1971 issue of JOURNAL OF THE ARNOLD ARBORETUM (Vol. 52, No. 1).

The second introduction of this tree into cultivation resulted from the Mulford Expedition for Biological Exploration of the Amazon Basin (1921-1922), which was headed by Dr. Henry H. Rusby, then Dean of the College of Pharmacy at Columbia University in New York. It included Dr. Orland E. White, plant breeder at the Brooklyn Botanic Garden (later, Director of the Blandy Experimental Farm of the University of Virginia). White was responsible for collecting seed of over 200 plants, including the same species of powder-puff tree that Hasskarl had collected earlier. The seed was germinated at the Brooklyn Botanic Garden and subsequently distributed from there. One of the original plants grown from this seed still exists in a greenhouse at the Botanic Garden. The leaflets of this introduction are somewhat larger than those of the population which Hasskarl introduced.

In 1896, between the two introductions, Rusby, who had previously received herbarium material from a collector in Bolivia, described this tree as *Calliandra inaequilatera*, believing it was a new species. Unaware of Hasskarl's venture to South America, horticulturists were confronted with two "species" of the powder-puff tree, one described from the Old World and another from the New World. Attempts to distinguish the two on morphological grounds have been futile, but they have commonly been maintained as distinct species because of the belief in a great geographical disparity in their origin. Our recent study (Nevling and Elias, 1971) details Hasskarl's trip to Bolivia and shows that both he and White collected seed in the same general area. It also demonstrates that the "two" species are one and the same, and concludes that the correct name of the powder-puff tree is *Calliandra haematocephala*. ♦

Another native tree in jeopardy . . .

Research on Ash Dieback

Craig R. Hibben

WHITE and green ash (*Fraxinus americana*, *F. pennsylvanica*) have been dying back for the past ten to twenty years in forests, hedgerows, and home plantings in New York, New Jersey, Pennsylvania, and much of New England. Ash dieback consists of a thinning of the canopy and a yearly dying back of terminal branches. Affected trees rarely recover. In fact, trees with this condition often die.

Dieback is a serious problem because ash is widely distributed in the eastern United States and forms an important part of the hardwood forests. Over the years, its wood, which has been used for a wide range of products, has had considerable commercial value. Also, in part because of their fast growth, white and green ash have been prominent trees in the nursery trade.

No single disease agent has yet been identified as the cause of ash dieback. However, research has shown that branches die as a result of two stresses on the tree: prolonged drought periods followed by invasion of the branches and trunk by canker fungi. The currently recommended practice to control the dieback is to cut out diseased limbs and give the tree extra feeding and watering.

Researchers at the Kitchawan Research Laboratory of the Brooklyn Botanic Garden, located at the field station in Ossining, New York, have been interested in this dieback problem from the standpoint of what role viruses and other sub-microscopic structures may play in this disease complex. Viruses are nucleoprotein particles that can be seen only at extremely high magnification and that multiply only inside living cells. Relatively little is understood about how viruses affect forest and ornamental trees.

Laboratory tests were begun in an at-

tempt to isolate and identify viruses from afflicted ash trees. A virus was recovered from ash leaves that had faint yellow spots and rings. This was done by rubbing leaves of bean or cow-pea plants with sap pressed from ash leaves. The extracted sap was first mixed with chemical reagents to protect the virus particles from toxic compounds released into the plant sap. Symptoms of virus infection—yellow or reddish-brown spots, rings, and lines—developed on the leaves of inoculated beans and cow-peas. From the symptoms induced on a wide range of non-woody test plants, plus laboratory analysis of its physical, chemical, and serological properties, the ash virus was identified as a strain of tobacco ringspot virus, a recognized plant pathogen.

By using a different technique, a sec-



Young ash in Dutchess County, N. Y.
About one-half of tree shows dieback



Ash ringspot virus as it looks on leaf of *Nicotiana tabacum* 'Turkish.'



Healthy ash leaf is shown in contrast to witches'-broom formations.

and disease agent was isolated from witches' broom formations. The brooms, which gardeners most often see on the common hackberry (*Celtis occidentalis*), are abnormally congested groups of twigs. In the case of ash trees afflicted with dieback, they grow on the trunks and have small yellow leaves. Dodder, a vine-like garden pest which entwines and parasitizes plants, was induced to grow on some of the witches' brooms of dying ash trees. Cuttings of the infected dodder were later transferred to plants of Madagascar periwinkle (*Vinca rosea*) in the greenhouse. This provided a means of transmitting an internal disease agent from the tree to a herbaceous host. The finding of a second pathogen became obvious when witches' broom symptoms developed on the parasitized periwinkle. The infectious nature of this agent was confirmed by its spread from diseased to healthy periwinkle by means of grafting.

The symptoms on both the ash and periwinkle are typical of yellows diseases, so-called because of the small, yellow leaves that develop on the proliferation of shortened branches. Until recently, yellows diseases were thought to be caused by viruses. Several yellows diseases of plants have now been attributed to unique organisms, heretofore identified only with human and animal diseases, called mycoplasmas. Mycoplasmas are

single-celled, amoeba-like bodies somewhat larger than viruses but smaller than bacteria. They congregate in the phloem sieve tubes, the food-transporting structures of green plants. Mycoplasmas are spread by feeding leafhoppers.

Veinal tissue and petioles of leaves from ash witches' brooms and infected periwinkle, as well as strands of dodder used in the transmission tests, were examined with an electron microscope at the Boyce Thompson Institute for Plant Research in Yonkers, N.Y. This instrument is capable of magnifying plant structures many times greater than light microscopes. Electron micrographs revealed the presence of abundant mycoplasmas in the phloem tubes of all three hosts, thereby implicating these bodies as the causal agents of witches' brooms on ash trees.

In summary, Brooklyn Botanic Garden researchers have isolated from ash trees and identified two sub-microscopic plant pathogens not previously known to be associated with forest or shade trees in the northeastern United States. Additional experiments are necessary before the capabilities and significance of the virus and mycoplasma are fully understood. However, it appears that viruses and mycoplasmas may constitute additional incitants among a complex of living and environmental stresses that in combination cause dieback in trees. ♦

Update Your Front Yard

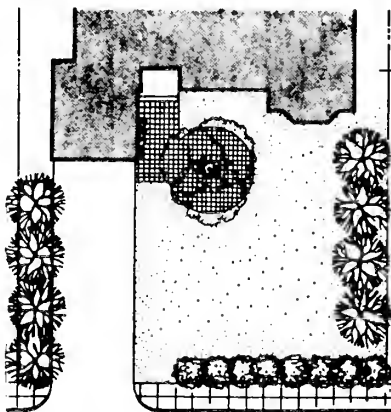
A well-known San Francisco landscape architect shows five different ways to redesign a front yard for greater use, beauty and privacy

Douglas Baylis

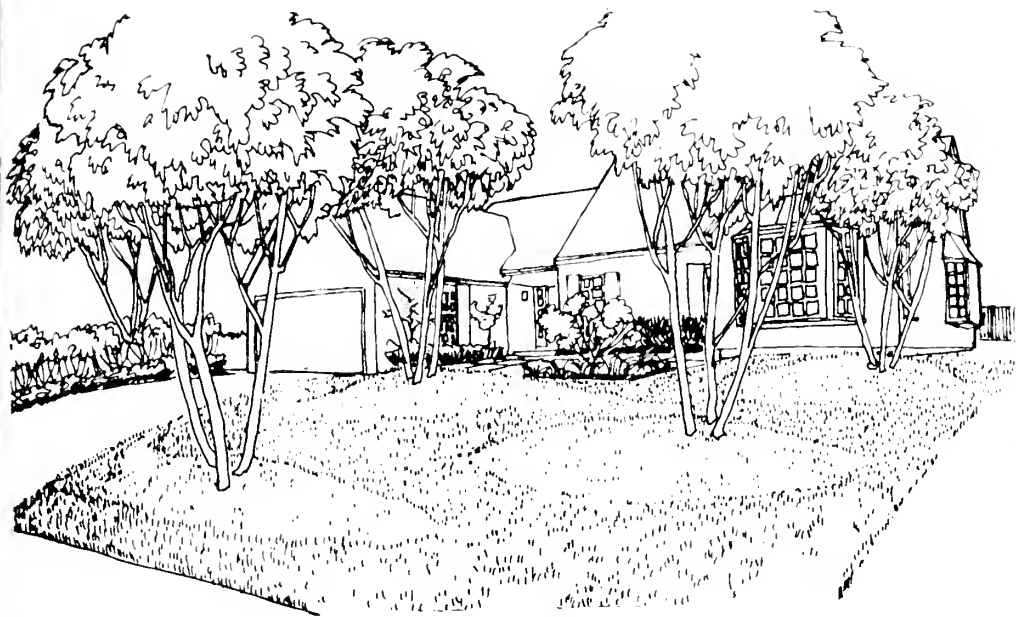
Reprinted from HORTICULTURE, May, 1970



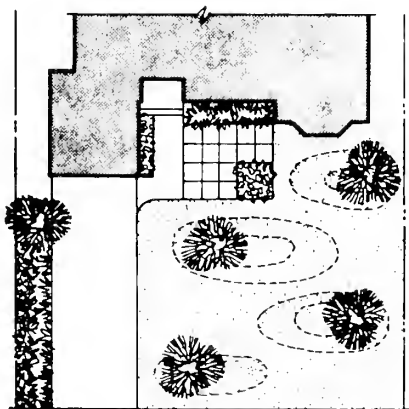
Above: A series of three planting screens in architectural form, but with very free growth combined with an entrance terrace which might be built around an existing tree in almost any position. The low, bushy, foreground screen gives a sense of privacy and setback. The property line screens can be as tall as necessary to achieve whatever sense of privacy may be required. The expanded paving creates an attractive entrance surface in scale with the larger tree. If no tree exists, I would decide where I want a tree and spend most of my money on the specimen. (In California we can get very old and picturesque trees in the \$100 to \$150 price range when we want an immediate effect.) Surfacing under this entrance tree could be sec-



tions of logs, old bricks or even tamped gravel. Notice that this scheme does not require any plants at the foundation line of the house. We do suggest one vine or espaliered plant between the windows.

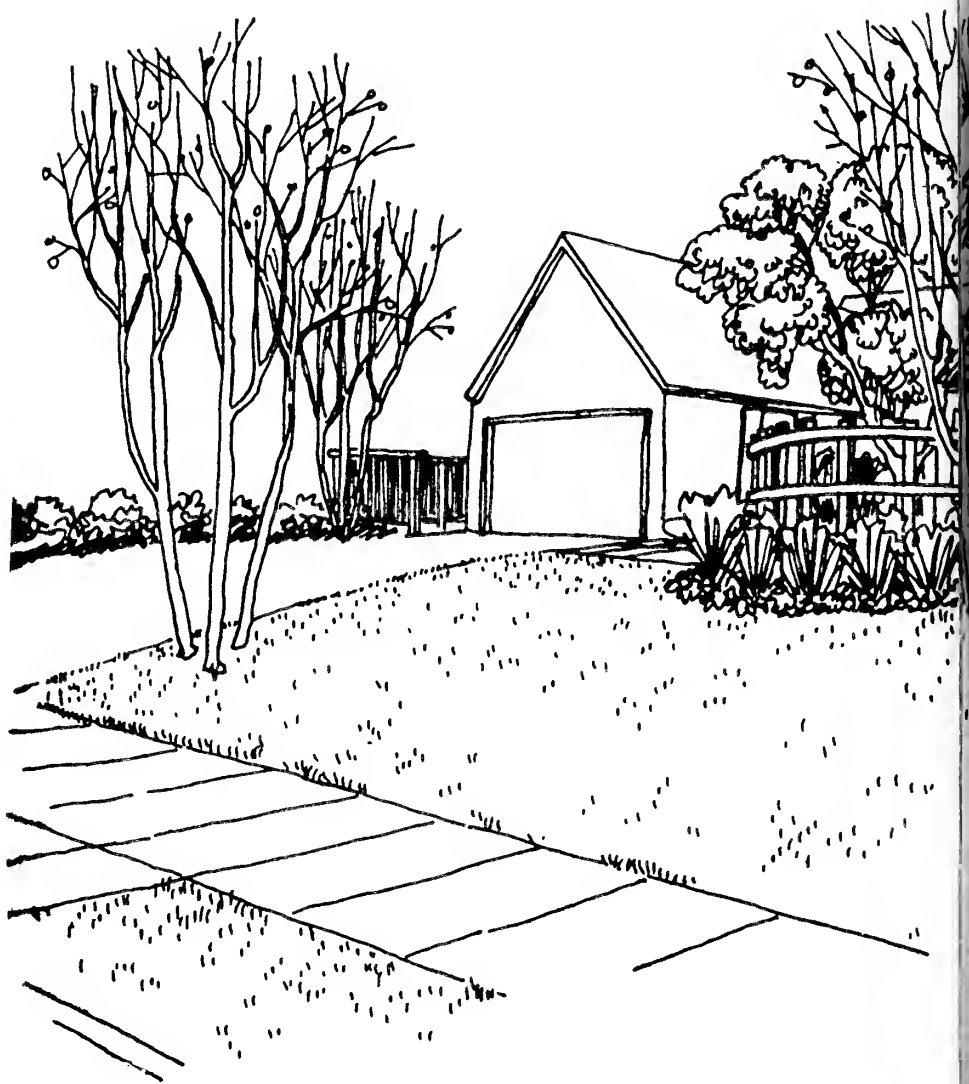


Above: The strength of a random-planted front-yard garden is the possibility of positioning trees to block the view out of the residence so a sense of privacy can be achieved. The best way to do this is to simulate the effect by placing stakes where trees might be located, judging the effect by looking out the windows and then going out to the street for the same purpose. Random placements are enhanced by mounding and modeling the lawn itself. For my taste I would also keep the grass mowed higher than my neighbors to give a meadow effect and include a few English daisies or other lawn "weeds". The lack of a front walk actually provides the illusion of a much larger lawn than really exists. The introduction of the paved surface (don't call it a patio) gives a friendly touch even if it isn't to be used for sitting. Shrubs and ground-covers planted in the strip between the property line and the garage entrance give a measure of separation and privacy from the neighbor. They also diminish the impact of a parked auto in the drive. This effect is improved fur-



ther by the use of multistem trees. Actually mounds can be added to an existing lawn without much trouble by removing the grass, adding the new earth, grading and leveling. Then reseed or resod the area once the trees are planted. Do not regrade around existing trees.

(Continued)



Update Your Front Yard

Here is an entrance patio with a fence-screen for vines to add privacy, flowers and fragrance. The tree could be an existing one or it could be planted in order to justify an entrance garden of this description.

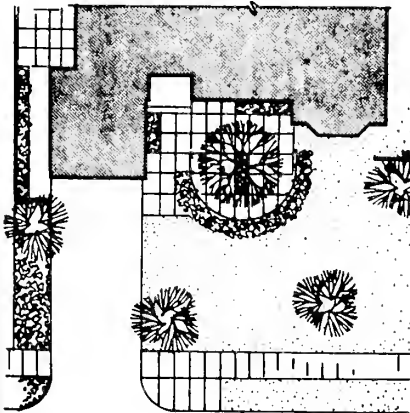
Notice that the tree clumps are planted in a circular pattern to subtly echo the curve of the fence-screen and paved surface. This tends to soften the intrusion of the terrace area into the front garden. The addition of a design of this sort gives a sense of uniqueness to a development home.

Where fence-screens are desired at the property lines, the fence is most effective if it comes forward of the house itself. This makes the fence free of the house and the gates, if any, can be readily concealed, if that should prove to be desirable or necessary.

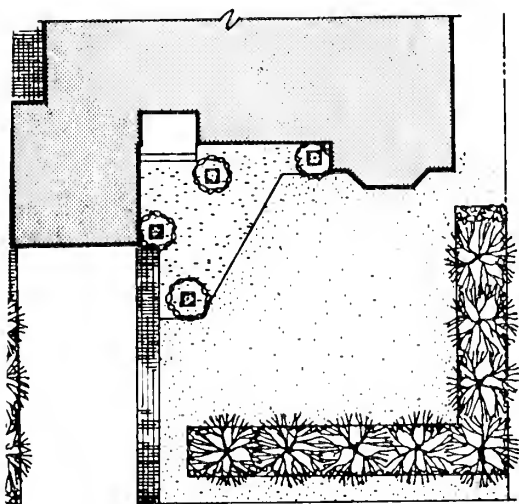
I also propose the expansion of the existing concrete sidewalk to give additional walking space for a person arriving or departing at the curb. Extra surfacing here is highly desirable during wet or winter weather.

Another variation would be to plant a groundcover in the strip between the street and a sidewalk as an additional area of rough textures in contrast to the fine tone of the grass.

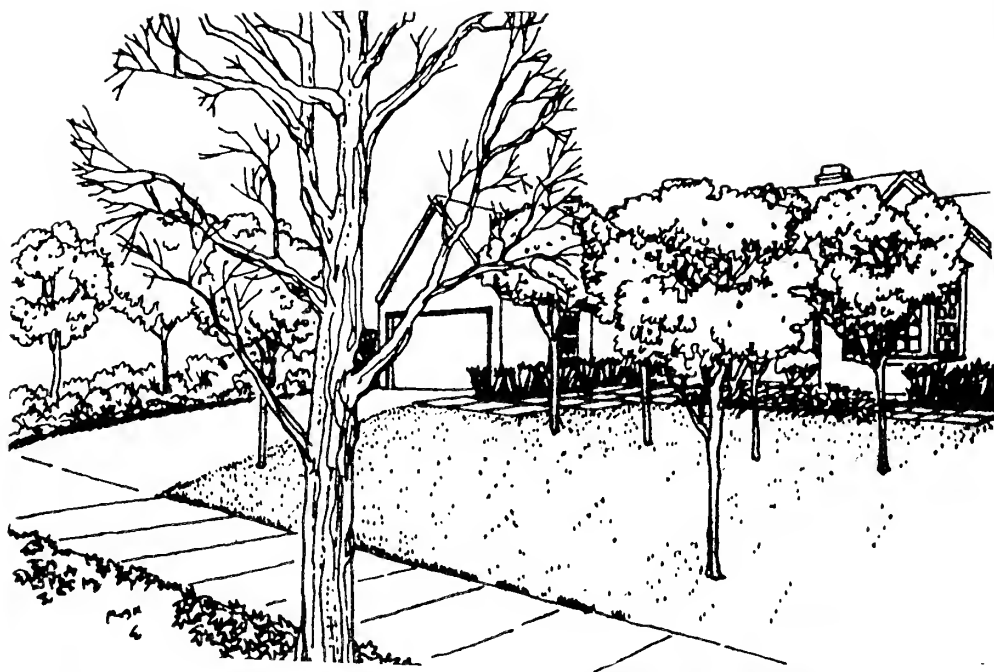
This design also works well when a sharp change of grade occurs between the sidewalk and the house. The entrance level then becomes very special.



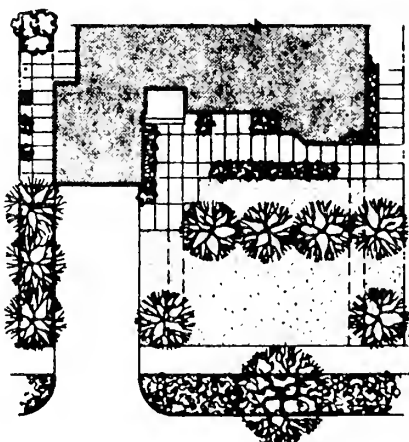
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This is both a new and a very old solution: a hedgerow treatment of trees to provide maximum space for the home and privacy from the street and neighbors. We expand the surface of the driveway with a ribbon of brick to make a walkway and an attractive edge to the driveway. We also suggest expanding the service walk adjacent to the garage to divert service traffic to a side entrance or kitchen area. The tree pattern suggests a roughcut method of pruning or training the trees. In the old days they might have been clipped a couple of times a year but who wants to do this nowadays? The entrance to the front door shows four specimens in plant tubs, although they could be the same trees planted in the ground instead. These could be formal trees like boxwood, lemon trees, oleanders, camellias or bay trees in southern climes, or Japanese maples. The tubs could be of a formal design and the trees not so formal in shape of growth. The trick is to have them large enough to not require watering every day. Large tubs start about 30 inches square and go up to 42. For the paved surface by the front door is suggested a rough-textured concrete in contrast to the brick edge, or it might be another kind or color of brick to be related but not match. The edges of the grass can be defined by bricks on edge or a redwood header.



Here we postulate that many homeowners have a street tree already in position which is likely to dominate the scene. On this basis the lawn trees can be smaller sorts and grouped. The plan may give the impression of a formal effect, but I believe the drawing provides the true feeling of architectural order and uniqueness. The order is enhanced by the suggested paving treatment. It is a platform that provides a base for the house and display areas for favorite plants. This idea lends itself to a series of colorful seasonal plantings or to an all-year-round effect with broad-leaved evergreens where possible. Low-growing conifers would be suitable, too. The trees should be of small size: crabapples, maples, redbuds, dogwoods. Notice the tree spacing, 12-14-16 feet apart depending upon the kind selected. The paved surface adjacent to the far side of the garage gives a special effect to an area that is rarely considered worth anything. Vines on the garage wall or the fenced property line are well worth considering. Our position on paving is



that you don't have to justify its existence, if it provides a way around the house without getting your feet wet or works as a platform for the house to sit upon visually. The dotted lines show two ways to have an entrance walk in this scheme, optional with you. ♦

Nursery Sources for Native North American Plants

Peter A. Hyypio

THE L. H. Bailey Hortorium at Cornell University in Ithaca, New York, has one of the largest collections of nursery and seed catalogs and price lists in the United States. Current and domestic catalogs received by the Hortorium are inventoried periodically and their offerings are recorded by source in a master card index of over 300,000 plant names. The following list is based upon catalogs received by the Hortorium within the past five years. It does not in any way constitute either a direct or implied endorsement of a particular firm. Any omissions are unintentional and should be

called to the author's attention (c/o L. H. Bailey Hortorium, Mann Library Building, Ithaca, N.Y. 14850).

The sources are listed alphabetically by states. The short statements describing their offerings are taken verbatim or nearly so from the catalogs, except in a few instances. Although most of the dealers cited specialize in native plant materials, several firms with smaller listings in other kinds of catalogs have also been included. Firms known to be wholesale only are so noted. Some dealers make a small charge for their catalogs; this is indicated when known.

Oakhurst Gardens, Box 444, Arcadia, Calif. 91006. Rare and unusual bulbs, many from the Southwest, Mexico and tropical North America. Catalog 50¢.

Clyde Robin, Box 2091, Castro Valley, Calif. 94546. Wild flowers, wild trees, seeds and plants. Catalog 50¢.

The Shop in the Sierras, Box 1, Midpines, Calif. 95345. Western trees, shrubs and herbaceous plants suitable for the home garden. Catalog 25¢.

Suter Nursery, 3220 Silverado Trail N., St. Helena, Calif. 94574. Seedlings and transplanted trees, including many native to California.

Central Nursery Co., 2675 Johnson Ave., San Luis Obispo, Calif. 93401. Seeds, including many native to North America.

Theodore Payne Foundation, 10459 Tuxford St., Sun Valley, Calif. 91352. California wild flower seeds and native plants. Catalog 50¢.

Edmund's Native Plant Nursery, **Burton's Oak Grove Nursery**, 2190 Oak Grove Rd., Walnut Creek, Calif. 94598. Plants, especially drought-resistant shrubs and trees, of California.

Ruth Hardy's Wildflower Nursery, Rte. 7, S. Canaan Rd., Falls Village, Conn. 06031. Native wild plants.

Lounsberry Gardens, Box 135, Oakford, Ill. 62673. Hardy wild flowers and ferns. Catalog 25¢.

Midwest Wildflowers, Box 664, Rockton, Ill. 61072. Seeds of plants native to midwestern United States.

Henderson's Botanical Gardens, Rte. 6, Greensburg, Ind. 47240. A commercial firm selling native wild flowers, ferns and medicinal plants.

Pellett Gardens, Atlantic, Iowa 50022. Some natives in a list of honey plants.

Bluemount Nurseries, Bluemount Rd., Box 219, Rte. 2, Monkton, Md. 21111. Some native plants and ferns in a list of perennials. Wholesale.

Blackthorne Gardens, 48 Quincy St., Haverbrook, Mass. 02343. Wild flowers and ferns, hardy native aquatic and bog plants in a catalog of lilies and other bulbous plants. Catalog 50¢.

Leslie's Wild Flower Nursery, 30 Summit St., Methuen, Mass. 01844. Wild flowers, seeds and ferns. Catalog 20¢.

Arthur Eames Allgrove, 281 Woburn St., North Wilmington, Mass. 01887. Wild flowers, ferns, trees, shrubs, carnivorous plants, terrarium plants. Wholesale and retail.

(Continue)

Dr. Hyypio's original list appeared in the Spring, 1968 issue of BAILEYA, a quarterly journal of horticultural taxonomy published at Cornell University. He has brought it up to date for this issue of PLANTS & GARDENS.



Gottscho Schleisner

This photograph of *Hepatica acutiloba* as well as the other photographs of native North American plants on the next few pages are the work of Samuel S. Gottscho, who died early in the year of 1971, only a few weeks before his 98th birthday. Although Mr. Gottscho is famous for his architectural and general garden photographs—many of which have appeared in *Plants and Gardens*—his special interest was the study and photographing of wild flowers and the places where they grow. Mr. Gottscho called the hepatica "the ethereal first flower of the early spring woods."

- F. W. Schumacher**, Horticulturist, Sandwich, Mass. 02563. Seeds for the nurseryman and forester.
- Arrowhead Gardens, Inc.**, 115 Boston Post Rd., Wayland, Mass. 01778. Many natives in a general list of perennials.
- Dutch Mountain Nursery**, Rte. 1, Box 167, Augusta, Mich. 49012. Trees, shrubs and vines for conservation practices.
- Harry E. Saier**, Seedsman, Dimondale, Mich. 48821. Native bog plants; seeds, including many native to North America. Catalog 50¢.
- Ferndale Nursery and Greenhouses**, Askov, Minn. 55704. Wild flowers and ferns.
- Orchid Gardens**, Rte. 3, Box 224, Grand Rapids, Minn. 55744. Hardy wild flowers, ferns and shrubs. Catalog 25¢.
- Ruth Mooney**, Hi-Mountain Farm, Rte. 1, Box 24, Seligman, Mo. 65745. Wild flowers from the Ozark Mountains; hardy ferns.
- E. C. Moran**, Stanford, Mont. 59479. Collector of tree, shrub and wild flower seeds.
- Charles H. Bickford & Son** (Successors to Isaac Langley Williams), Exeter Wild Flower Gardens, Box 510, Exeter, N.H. 03833. Collected native trees, shrubs, wild flowers, ferns. Wholesale.
- Francis M. Sinclair**, R.F.D. 1, Newmarket Rd., Exeter, N.H. 03833. Collected native plants, evergreens, trees and shrubs. Wholesale.
- Radford H. Palmer**, R.F.D. 1, Durham, N.H. 03834. Collected nursery stock of wild flowers, ferns, orchids, lilies, aquatic and bog plants, evergreens, trees and shrubs. Wholesale.
- Eugene Mincmoyer**, Rte. 4, Box 482, New Prospect Rd., Jackson, N.J. 08527. Wild flowers, ferns and herbs.
- Herbst Brothers**, Seedsmen, Inc., 1000 N. Main St., Brewster, N.Y. 10509. Seeds for nurserymen and commercial growers. Wholesale.
- Curtis Nurseries, Inc.**, Callicoon, N.Y. 12723. Trees and shrubs, some collected. Wholesale.
- Peter Paul Nurseries**, R.D. 4, Canandaigua, N.Y. 14424. Carnivorous plants.
- Martin Viette Nurseries**, Rte. 25A, East Norwich, N.Y. 11732. Many nursery-grown wild species of perennials, shrubs, trees and evergreens in a general catalog. Does not ship. Catalog 50¢.
- John Scheepers, Inc.**, Flower Bulb Specialists, 63 Wall St., New York, N.Y. 10005. Hardy native orchids, ferns, trilliums and erythroniums, in a catalog of flowering bulbs.
- Max Schling**, 270 W. Merrick Rd., Valley Stream, N.Y. 11582. Some hardy wild flowers and ferns in a general catalog.
- E. C. Robbins**, Gardens of the Blue Ridge, Ashford (McDowell Co.), N.C. 28603. Hardy plants of the Blue Ridge Mountains, including bog and aquatic plants.
- The Three Laurels**, Marshall, N.C. 28753. Wild native flowering plants and ferns.
- Mellinger's Inc.**, 2310 West South Range Rd., North Lima, Ohio 44452. A general horticultural catalog including many native trees and shrubs, wild flowers and ferns.
- Sunny Farms Nursery**, 9448 Mayfield Rd., Chesterland, Ohio 44026. Hardy native ferns and wild flowers.
- Walter Marx Gardens**, Boring, Ore. 97009. Many choice natives featured among general garden plants.
- Edgar L. Kline**, 17494 S.W. Bryant Rd., Lake Grove, Ore. 97034. Native bulbs and seeds. Wholesale.
- Siskiyou Rare Plants Nursery**, 522 Franquette St., Medford, Ore. 97501. Native plants from the mid-coastal region of Oregon and California. Catalog 50¢.
- Forestry Associates**, Box 1069, Allentown, Pa. 18105. Seeds of many native trees and shrubs.
- Vick's Wildgardens, Inc.**, Box 115, Gladwyne, Pa. 19035. Wild flowers and ferns.
- Charles H. Mueller**, Bulb Specialist, River Rd., New Hope, Pa. 18938. Wild flowers in a list of spring-flowering bulbs.
- Claude Barr**, Prairie Gem Ranch, Smithwick, S.D. 57782. Collector of native seeds and plants.
- Wild Flower Habitat**, Lloyd Tate, Box 251, Beersheba Springs, Tenn. 37305. Native plants.
- Savage Gardens**, Box 163, McMinnville, Tenn. 37110. Wild flowers, ferns, wild flowering shrubs.
- Robert Nicholson Seed Co.**, 2114-18 N. Lamar St., Dallas, Tex. 75204. Some Texas wild flowers and southern grasses in a catalog of garden, field and flower seeds.
- Sky-Cleft Gardens**, Camp St. Ext., Barre, Vt. 15641. Many American wild plants in a list of rock garden perennials.
- William Crosby**, Nurseryman, Charlotte Vt. 05445. Collected and nursery-grown trees, ferns and other plants.

(Continued)



Gottcho Schloisner

Mr. Gottcho photographed this classic woodland trio—a birch, a fern clump and the yellow lady-slipper—in a Connecticut garden. Right: The showy lady-slipper (*Cypripedium reginae*) is termed "our most beautiful native orchid" by Samuel Gottcho.





Gottschö-Schleisner

The trout-lily or dogtooth-violet (*Erythronium americanum*), another of Samuel Gottschö's favorites among the spring-flowering native plants.

Putney Nursery, Rte. 5, Putney, Vt. 05346.
Wild flowers and ferns. Catalog 25¢.

Gardenside Nurseries, Shelburne, Vt. 05482.
Native plants.

The Wild Garden, Box 487, Bothell, Wash.
98011. Native and other wild plants.
Catalog \$1, deductible on first purchase.

Laura E. Jezik, Laura's Collectors' Garden,
5136 S. Raymond St., Seattle, Wash.
98118. List includes western wild flowers
and ferns.

Jamieson Valley Gardens, Jamieson Rd.,
Rte. 3, Spokane, Wash. 99203. Wild flow-
ers, western natives, native bulbous
plants and orchids, ferns. Catalog 50¢.

L. L. Olds Seed Co., Box 1069, Madison,
Wis. 53701. Native wild flowers and
ferns. Spring shipments (until May 15)
only; no shipments to California, Alaska,
Hawaii, Florida or foreign countries.

Woodland Acres Nursery, Frank and Marie

Sperka, Rte. 2, Crivitz, Wis. 54114. Wild
flowers and ferns.

Wild Life Nurseries, John L. Lemberger,
Box 399, Oshkosh, Wis. 54901. Native
aquatics used in conservation practices.

Canada

Lakeview Gardens, E. H. Lohbrunner, 1101
Lohbrunner Rd., Victoria, B.C. Woodland
plants and ferns.

Alpenglow Gardens (Michaud & Co.), 13328
King George Highway, North Surrey,
B.C. Hardy alpiners, perennials and
shrubs.

Ashby's Garden Centre & Nursery, RR 2,
Cameron, Ont. Native wild flowers in a
catalog of perennials, herbs, fruit trees
and ornamental trees.

**C. A. Cruickshank, Ltd. (The Garden
Guild)**, 1015 Mount Pleasant Rd., To-
ronto 12, Ont. Woodland plants. ♦

New Plant Hormone Isolated

F. T. Addicott

Condensed from HORTICULTURE, February, 1970

A NEW plant hormone that promotes the shedding of leaves, inhibits growth, and induces dormancy has been isolated by a research group at the University of California at Davis.

What makes leaves fall at the appropriate time has long puzzled humans. Short days, approaching cold and other factors have variously been credited with bringing this about—but what is the actual agent, the alarm clock, which sets the dropping into motion? It is apparently the newly isolated hormone, abscisic acid, which gradually overcomes the growth hormones so that their influences weaken as autumn approaches.

In the course of the group's investigations of the hormones in developing cotton fruits, we discovered a substance strongly antagonistic to growth. Further, the substance actively promoted fruit and leaf abscission (shedding). It appears to function as a hormone in promoting abscission, that is, it acts powerfully in very small amounts. One hundredth of a microgram (about 1/100,000,000 of a teaspoon) will strongly promote the shedding of a leaf.

Other investigations disclosed the presence of this newly recognized substance in the leaves of deciduous trees, such as maples and birches, during the short days of fall. Wareing's experiments suggest that abscisic acid functions as a hormone, inducing dormancy in the vegetative buds of deciduous trees.

In trees it originates in the leaves and is transported to the terminal buds where it arrests growth and induces dormancy. It is not yet clear that dormancy in leaves can be induced by the small amounts characteristic of hormonal action, although this will probably prove to be the case. With excised (cut out) buds of potato tubers, dormancy can be prolonged by very small amounts of abscisic acid. At the same time Van Stevenick's work in-

dicates that abscisic acid functions as an abscission-inducing hormone in lupine fruit.

Further, this acid is able to prevent the germination or prolong the dormancy of many kinds of seeds, including rose, peach, avocado and grasses. Nearby tissues serve as a source of abscisic acid. In peaches the acid is present in the seed coats and in the rose it is in the fruit.

With respect to dormancy, the amount of abscisic acid in the leaves of deciduous trees was found to increase with the arrival of the short days of autumn. Also leaf applications of extracts containing abscisic acid arrested growth of the special or end buds and induced bud changes characteristic of dormancy.

With respect to flowering, it is felt that this substance may be the inhibitor when long-day plants are grown under short-day conditions. In those short-day plants tested, results proved variable, however. In some short-day plants the substance seems to promote flowering, but actually does so only indirectly by retarding vegetative growth.

Quite recently Mittelheuser discovered a new function of abscisic acid: its ability to bring about the closure of the leaf's stomates (pores). Abscisic acid concentration rapidly increases when a leaf wilts and thus the hormone aids in the conservation of water by closing the stomates.

The newly isolated hormone may be considered as something of a balancing factor in the machinery of the plant, tending to hold in check the growth-promoting forces. Correlated with this general influence is the substance's strong ability to promote senescence and abscission, to induce and prolong dormancy, and to reduce wilting. Research on abscisic acid has disclosed new aspects of the hormonal control of plant behavior and points the way to improved methods for the regulation of plant development by man. ♦

The true oriental plane is a rare species in this country

The Oriental Plane in the United States

Frank S. Santamour, Jr. and Frederick G. Meyer

Condensed from THE AMERICAN HORTICULTURAL MAGAZINE, Winter, 1970

THE TRUE ORIENTAL PLANE (*Platanus orientalis*) a native of southeastern Europe and western Asia, has long been considered a rare plant in cultivation in this country. However, because of widespread confusion in the nomenclature of the plane trees, the names "oriental" or "*orientalis*" are still used by some nurseries in describing plants that do not belong to the true species.

The cause of the confusion is the London plane, *P. × acerifolia*, a heterogeneous group of hybrids or hybrid derivatives of a reputed natural cross between *P. orientalis* and the native American sycamore, *P. occidentalis*. The London plane is one of the most widely used shade trees in urban areas of the United States. While it may be that the first form of this hybrid originated in the Oxford Botanic Garden about 1670, as deduced by Henry and Flood (1919), it is also possible that other hybrids arose spontaneously in several countries at about the same time. In any event, their lack of familiarity with the American species led many European botanists to consider the hybrids as varieties or forms of the oriental plane. When the first London planes were imported into North America, they too were called *P. orientalis*.

Li (1957) has noted the occurrence along city streets of individual trees which could be identified as oriental planes. Such trees should be regarded as advanced generation segregates of the hybrid London plane that have inherited many of the characteristics of *P. orientalis*. The common usage of open-pollinated progenies of London planes for city plant-

ing has resulted in trees approaching both parental species in many characters, as well as an abundance of intermediate types.

Anthracnose Disease

Because of interbreeding among London plane introductions and backcrossing of the hybrids to *P. occidentalis*, our city plane trees also exhibit a wide range of susceptibility to the anthracnose disease. Sycamore anthracnose, also known as twig or leaf blight, is caused by the fungus *Gnomonia veneta*. Another name for the sexual stage is *Gnomonia platani*, while the asexual stage on leaves is known as *Gloeosporium platani*. Himelick (1961), and Neely and Himelick (1963) have found that disease symptoms, the most apparent of which is the dying back of young twigs in the spring, are most severe during periods of cool weather following bud break. This disease is currently a primary deterrent to more widespread planting of plane trees in the North.

Walther (1935) was among the earliest to note variation in anthracnose susceptibility among London planes. He observed that in San Francisco, California, the more resistant trees tended to resemble *P. orientalis* in leaf characters. However, other resistant trees may be quite intermediate in leaf type. Thus, the conflicting published statements about the anthracnose resistance of the London plane and the oriental plane can be traced to the hybrid origin of the trees. All authorities agree, however, that our native *P. occidentalis* is generally highly susceptible.

With the expansion of research in the

project on Cytogenetics, Breeding, and Evaluation of Shade and Ornamental Trees at the U.S. National Arboretum in 1967, it was decided to give high priority to the genus *Platanus*. Since the planes are among our most widely used street trees, there is considerable opportunity for selection among the various urban tree populations. Furthermore, there is a need in the genus for genetic improvement of several growth characteristics, including disease resistance and tolerance of air pollutants.

We were fortunate in having at the Arboretum 16 sexually mature trees of *P. orientalis*. The original geographic source of our trees was Duzce, Asku Deresi, Turkey, growing at an elevation of about 450 feet. The collection, introduction, and distribution of the seed from which these trees were grown was arranged by F. G. Meyer in 1954, while he was associated with the Missouri Botanical Garden. The availability of these trees at the National Arboretum has enabled us to make some meaningful observations on this species, and utilize them in genetics and breeding research.

Oriental Plane in the U.S.

We have also become interested in the actual extent of cultivation of the oriental plane in the United States, and sent inquiries to more than 25 botanical, horticultural, and forestry institutions throughout the country for information on their experience with *P. orientalis*.

Most arboreta in the eastern United States, north of Washington, D.C., have attempted to grow *P. orientalis* on several occasions (up to 15 different clones at the Arnold Arboretum). The plants usually survived long enough to be planted out from the nursery. However, after several years, most of these died before reaching flowering age. Some institutions also have young plants on their grounds at the present time. Two trees, still in the nursery of the Monroe County (New York) Department of Parks, are the exception to this pattern. These trees, 12 and 15 feet in height (November, 1967), were grown from the same seed collection as

the National Arboretum trees, and they are producing fruit.

This seedlot has also given rise to five plants at the University of Washington Arboretum. The largest tree (about 45 feet tall in 1967) fruited for the first time in 1964. The only other institution that reported fruiting trees was the Los Angeles State and County Arboretum, where an individual obtained in 1954 produced its first fruit in 1965.

While it is evident that the oriental plane is rare in cultivation, it is also apparent that one major seed introduction has proved its adaptability in warmer regions of the country.

The trees of *P. orientalis* at the National Arboretum (Washington, D.C.) are growing rapidly (largest tree 44 feet in height), and have not been injured by cold weather. However, the growth habit of the trees is not especially good. Most of the trunks show a pronounced sweep and a few are multiple-stemmed.

The rather limited area of the country in which the oriental plane appears to be hardy will certainly be a limiting factor in the direct use of this species for street and ornamental planting. But the species should be most useful in other ways. Our observations in Washington, D.C., as well as those in Seattle, indicate that the trees are highly resistant to sycamore anthracnose. Furthermore, preliminary studies indicate that they are also more tolerant of air pollution than many progenies of *P. occidentalis* or London plane. With controlled hybridization of the best oriental plane with the hardiest native sycamore, we should be able to develop disease-resistant, pollution-tolerant, cold-hardy cultivars adaptable to a wide range of climatic and site conditions.

It is interesting to note that in the 300 years since the chance occurrence of the London plane, there has been no published report on an attempt to create hybrids between *P. orientalis* and *P. occidentalis*. In the spring of 1968, F. S. Santamour, Jr., made reciprocal crosses between the two species, and we should soon have a new generation of "London" planes for further experimentation. ♦

Americans are now aware of the dangers from heavy or careless use of pesticides . . .

To Spray or Not to Spray?

P. P. Pirone

Condensed from the New York Botanical Garden's GARDEN JOURNAL, October, 1970

THE RECENT banning of the so-called "miracle" insecticide DDT has made many Americans more keenly aware of the dangers involved in the promiscuous or careless use of many pesticides.

At the time DDT was introduced, no studies had been made on its "biodegradability," that is, the rate at which it breaks down to an inert substance. It is now known that DDT, as presently manufactured, is almost indestructible, persisting in soil and water for years. Many other pesticides presently in use are potentially very dangerous to people, pets, and wildlife for this and other reasons.

The pesticide question is, however, a complex one. Some toxic materials are extremely effective and often necessary to combat pests and diseases that attack man himself and those that attack food, fiber, and ornamental plants upon which he depends.

Until more effective substitutes are developed, it would be foolhardy, if not worse, to eliminate all pesticides as some well-intentioned but mis-informed advocates would have us do. *The real question is not one of use, but of abuse and misuse.*

Some plants, highly susceptible to insects, fungus and bacterial diseases, cannot be grown successfully without the use of sprays. Roses and many ornamental trees and shrubs, such as lilacs and flowering cherries, cannot be grown for long without the aid of pesticides. If growers were suddenly forced to discontinue using pesticides, potato production in the eastern United States would be drastically reduced and peaches and citrus fruits would almost completely disappear from the markets. Without the pesticides, herbicides, and chemical fertilizers now being used, only forty per cent of our

population would have adequate quantities of food and fiber crops. *For the foreseeable future, we must still rely on certain pesticides to keep major pests and diseases of food and fiber crops and some ornamentals under control.*

Chemicals, as any other agents that manage man's environment, must be used with just regard to man's safety and the ecological system of which he is a part. Obviously, where two pesticides are effective in controlling a certain pest, the one that is more quickly "biodegradable" should be selected.

It is well to remember, moreover, that spraying chemicals on plants is not a substitute for good gardening practices. You cannot neglect more traditional gardening procedures, such as applying plant food, controlling weeds, avoiding overcrowding and watering properly, and still produce healthy plants. Nor should you apply sprays to all plants in a given area whether they are infested with pests or not. The application should be restricted to smallest area possible and should be made with good equipment.

Before embarking on a spray program, you should first identify the pest or disease by means of books, pamphlets, or other printed matter. If this is not possible or is difficult, seek assistance from your local county agricultural extension service entomologists, or plant pathologists at State Colleges of Agriculture, and the U.S. Department of Agriculture, or from other qualified persons.

In the recently published 4th edition of *Diseases and Pests of Ornamental Plants*, I did not recommend the use of nine pesticides: aldrin, BHC, DDT, DDD, dieldrin, endrin, heptachlor, parathion, and toxaphene, either because of

their extreme toxicity or their high degree of indestructibility.

Chlordane and lindane, two chlorinated hydrocarbons that decompose more quickly than DDT, were recommended with limitations and only until such time as equally effective substitutes are found.

As a substitute for DDT, I recommend methoxychlor. More quickly "biodegradable" than DDT, its residual action lasts about two weeks when applied to plants as compared to three months or more for DDT. Its LD_{50}^2 is 5000 to 7000 as compared to 250 for DDT. In terms of human toxicology, the fatal dose of methoxychlor for many would be 450 grams (1 pound) if ingested at one time, while for DDT it would be 30 grams (1 ounce).

Here are some of the pesticides that are recommended for use around the home, together with the recommended dosages and the pests they control. They can be safely used with very little chance of harm to people, pets, or the environment, provided they are used as recommended by the manufacturer.

Carbaryl (trade name SEVIN). LD_{50} 500, 2 T.³ 50% WP⁴ per gallon water. Controls: bagworm, leafminers, leaf beetles, Japanese beetles, Japanese weevil, periodical cicada, some caterpillars, webworms, skeletonizers, sawflies, spittlebugs, and the crawler stage of some soft and armored scales. Side effects: Too frequent use of carbaryl often increases spider mite population on some plants; can cause defoliation of Boston ivy and Virginia creeper, and is toxic to bees.

Chlordane, LD_{50} 570, 3 T. 40% WP, or 1 t. 75% EC⁵ per gallon water. Controls: ants, Japanese weevil, and taxus weevil.

Chlorobenzilate, **Genite**, **Kelthane**, and **Tedion** are recommended for spider mite control.

Cythion is a premium grade of malathion. See under malathion.

Diazinon, LD_{50} 134, 2 T. 25% WP, or 1½ t. 25% EC per gallon. Controls: azalea, birch, and boxwood leafminers; whitefly, bagworm, Fletcher scale, and pine tree moth.

Dimethoate (Cygon), LD_{50} 1000, 1 t. 30.5% EC per gallon. Controls: hemlock florinia scale, honey locust mite, and pine



Masses of the eastern tent caterpillars feeding on the foliage of a wild cherry tree—an all-too-familiar sight by roads in early summer.



*All photographs from
Diseases and Pests of Ornamental Plants*

The glistening black egg cases of tent caterpillars which are wrapped securely around twigs and branches.



Tiny cotton tufts left by pine bark aphids protect the eggs during winter. The control of the aphids is with malathion or lindane.

needle scale; in stronger solution, 4 t. of 30.5% EC per gallon. Controls: Nantucket pine tip moth, European pine tip moth, taxus mealybug, euonymus scale, and pine bark aphid.

Dormant Oil, $\frac{1}{2}$ to $\frac{3}{4}$ cup. Controls: some species of aphids, mealy bugs, mites, soft scales (cottony maple, European elm, magnolia and tulip-tree), and some armored scales.

Dormant oil plus Ethion, $\frac{1}{2}$ cup EC per gallon water: Controls euonymus, hemlock, oystershell, pine needle, and tulip-tree scales; taxus mealybug, gall mites, and spruce gall aphids (except on Colorado blue spruce).

Endosulfan (Thiodan) LD₅₀ 200, 2 t. 50% WP or 2 T. 24% EC per gallon water. Controls: aphids, taxus bud mite, and many borers.

Lindane, LD₅₀ 125, 1 T. 25% WP, or $\frac{1}{2}$ t. 20% EC per gallon water. Controls: some aphids, locust borer, coleopterous borers, and white pine weevils.

Malathion (also sold in premium grade as Cythion), LD₅₀ 1375, 4 T. 25% WP, or 1 to 2 t. EC per gallon water. Controls: aphids, bagworms, case bearers, gall aphids,

leafminers on azalea, birch, boxwood, elm, and hawthorn; mealybugs, psyllids on boxwood and hackberry, whiteflies and some chewing insects. Malathion and the premium grade Cythion have short residual lives of 3 to 4 days; they should not be used within a week of harvest of food plants.

Methoxychlor, LD₅₀ 5000 to 7000, 2 T. 50% WP, or 1 T. 25% EC per gallon water. Controls: caterpillars, beetle larvae, webworms, sawflies, crawler stage of scales, elm bark beetles.

Pyrethrum and Rotenone. These botanical (derived from plant parts) insecticides are still available. Pyrethrum combats most sucking insects, while rotenone controls most chewing insects.

Systemic Pesticides

The use of systemics is another way to control insects and some fungi. These substances are absorbed through the roots or leaves, translocated via the sap stream to destroy insects, mites, and fungi feeding or breeding in the plants.

Systemic insecticides should be used with great care because of their high



The bagworm, often found on arborvitae, may be eliminated by hand-picking or a spray of malathion.

toxicity. Among the safest ones are META-SYSTOX R, DI-SYSTON, and CYGON.

Several systemic fungicides have been developed recently. BENOMYL (BEN-LATE) controls black spot and powdery mildew of roses and kills spider mites as well. It is applied as a foliage spray, or directly to the soil where it is absorbed by the roots and transported to the leaves. Benomyl, moreover, is not highly toxic.

Another systemic fungicide, TBZ or THIABENZOLE, controls several fungus diseases.

Biological Controls

Biological control of insects includes the use of parasites, predators, and bacterial and virus organisms. In her book *Silent Spring* Rachel Carson advocated this type of approach. Much research is now seeking to find parasites for the more destructive insects.

While it is true that, in a few instances, parasites and predators have controlled destructive insects successfully, it is unrealistic to expect biological controls alone to completely control pests. During the past eighty or so years, the U.S. Department of Agriculture has imported five-hundred-twenty natural enemies of pests. Only one-hundred-fifteen of these have survived and become established, and only approximately twenty have substantially controlled the pests they were imported to combat.

This is not to say that man's creative mind will not discover some simple non-toxic solutions for his plant pest problems. Recently beer was found to be a useful pesticide, more effective for controlling slugs than the long-recommended (and highly toxic) chemical metaldehyde. In a four-day test at the Agricultural Research Center, in Beltsville, Maryland, Dr. Floyd Smith observed that three hundred grey slugs crawled into shallow pans containing beer and soon died, victims of drowning. Metaldehyde bait killed twenty-eight grey slugs in the same period. ♦

¹Recently the Aerojet-General Corporation, El Monte, Calif., developed a DDT that "self-destructs" after it is no longer needed. This formulation has a built-in capacity to degrade into compound "only 10% as toxic as original DDT".

²The term "LD₅₀" stands for "lethal dose required to kill one half (50 per cent) of a group of test animals". The dosage is expressed as a ratio: The amount of pesticide, in milligrams, per 1000 grams of body weight of the test animal concerned (usually rats). For example, an LD₅₀ of 5 is a dosage

of 5 milligrams per 1000 grams of body weight. All pesticides specify lethal dose in a standard form, and thus comparison of dosages indicates relative toxicity. A minute quantity of a pesticide of 5 or less would be fatal to man or animals. For man, pesticides with an LD₅₀ value of 500 or above are relatively safe; a probable lethal dose would range from one ounce to one pint or one pound.

³T = level tablespoon, t = level teaspoon

⁴WP = wettable powder

⁵EC = emulsifiable concentrate

Botrytis--An Indiscriminate Killer

Malcolm C. Shurtleff

Condensed from GROUNDS MAINTENANCE, September, 1970

BOTRYTIS, or gray mold, is one of the commonest of fungi, attacking a wide range of ornamental, fruit and vegetable plants. It produces a variety of symptoms, including bud rot, blossom blight, ripe fruit decay, leaf blight, damping-off of seedlings, stem or twig blight on older plants, even a decay of bulbs, tubers, roots, and corms. Sometimes several different plant organs are attacked on the same plant. Damage is most severe during or following cool cloudy weather, in greenhouses as well as outdoors.

Botrytis gets its name from the Greek word *botrys*, meaning a cluster of grapes, and this is just what the masses of egg-like spores of Botrytis look like under a microscope. To the unaided eye, clusters of Botrytis spores appear as a fuzzy, gray-to-tan dusty mold growing on infected tissues. The spores are easily dislodged by wind, rain or overhead sprinkling and carried on a gardener's tools or hands or by insects or mites.

Some strains of Botrytis occur strictly on injured, dead, or dying plant parts, while others cause diseases such as tulip fire, lily and peony blight, fruit rot, twig blight, bud and blossom blight, cutting rot, crown rot, cane canker and stem rot. Botrytis usually appears as soft, light tan to dark brown, decay spots or blotches on leaves, flowers, crowns, fruits, tubers, bulbs and roots. Young shoots soon wilt, darken and collapse. Flower buds turn brown or black and, if they open, are often distorted, watery or matted and sprinkled with irregular flecks or spots. Older flowers turn dark brown, rot and quickly wither. In muggy weather, affected plant parts are soon covered with gray mold.

Rapid buildup of Botrytis in flower beds and other landscape plantings is commonly associated with senescent leaves and flowers, or conditions unfavor-

able to plant growth such as unbalanced nutrition, ozone injury, overwatering, chilling or sunburn, hail or insect injury or another disease. The gray mold fungus feeds on dead or dying tissue and, using this as a food base, grows into adjacent healthy tissue. Leaf and stem infection frequently occurs when withered flowers drop on them.

Epidemics of gray mold are associated with rainy weather or syringing in the foliage because a film of water on plant foliage is necessary for spore germination and infection.



Stem rot of geranium.



Bud blight on peony.



Bulb rot on tulip.

Nine Steps in Controlling Botrytis

1 Space plants for good light and circulation. Avoid shady or low spots and control weeds.

2 Fertilize, based on a soil test. Avoid overfertilizing with nitrogen. Be sure to maintain adequate levels of potash, phosphate and calcium.

3 Avoid wet mulches (especially close to young stems), syringing plants and overhead watering from mid-afternoon on.

4 Where feasible, promptly cut and burn infected plant parts or whole plants. Carefully remove fading flowers. Cut and burn, bury or compost tops of flowers in the fall.

5 Do not work with plants when they are wet.

6 Dry, clean and cure bulbs, rhizomes, tubers and corms before storing at the recommended temperature and humidity. Inspect all propagating materials before planting and discard all which show de-

cay, gray mold, or hard black bodies (sclerotia) that help the Botrytis fungus survive unfavorable periods.

7 In greenhouses and hotbeds, keep the air humidity below 85 per cent with heat and increased ventilation.

8 Take cuttings from healthy plants and propagate in a sterilized soil mix.

9 During cool damp weather, keep the foliage of susceptible plants protected. Spray at five-day intervals with a fungicide containing captan, zineb, Daconil 2787, thiram, difolatan, folpet (Phaltan), Dyrene, Botran, Polyram, maneb and zinc ion (Fore), or benomyl (Benlate.) Follow the manufacturer's directions as printed on the package label. If the foliage is glossy or waxy and hard to wet, (e.g. carnation, gladiolus, iris, peony), add a spreader-sticker to the spray. Lightly mist-spray flower buds when they begin to show color. Use zineb or captan at half the normal rate ($\frac{3}{4}$ lb. per 100 gal., 1 tablespoon per gal.). Termil or Exotherm are tablet forms of Daconil 2787 for use in greenhouses.

*Understanding the pine mouse way of life
is necessary to achieve any measure of control*

Pine Mouse Damage Prevention

Frank Horsfall, Jr.

Condensed from the PROCEEDINGS OF THE 46TH MEETING of the HOLLY SOCIETY OF AMERICA,
INC., October, 1969

PINE MICE can be found practically at any time of the year in grass brushland and among woody agricultural plants from Georgia to Massachusetts. Regardless of the applied controls, these rodents, with an extremely destructive potential, are usually permanent residents. Under severe test conditions, even a few mice can be hazardous. Unless herbaceous cover is in considerable variety, risks may continuously threaten trees in the many grassland complexes of man. Quite incidentally in horticultural practice, we usually provide the almost ever present pine mouse with a restricted diet composed mostly, or nearly so, of many horticultural trees that grow among a single species of herbs or in a severely restricted base of herbaceous plants. In nature the animals' niche is best found among the rich forest edge flora that is composed of numerous species of woody plants and herbs. In such a forest edge habitat, which is plentifully supplied with herbs, woody plants live in comparative safety. Usually with certain marked deficiency differences, the general appearance of a horticultural planting frequently or perhaps superficially resembles the forest edge. Even so, pine mice are quite at home in most orchards and similar plantings and may cause serious tree injury.

Any of the following facets associated with pine mouse life are found to importantly modify and may seriously impede effective damage control.

1. Toxicant action may be weak and is rarely 100% effective.
2. Toxicant action alone is sporadic and not continuously operative.
3. Even with 100% kill in November, mice invade from May to December.

4. A few mice almost certainly infest the planting all of the year.
5. By choice, mice require support of diverse plant species.
6. Both grasses and broadleaf plant feeds are necessary.
7. Mouse feed is principally from perennial plants.
8. Mice persistently cache feed for winter.
9. Only perennial plant parts are cached.
10. Mouse-carrying capacity of horticultural sites is extremely variable.
11. Drought may induce great mouse hazard especially in small valleys.
12. December through April is a season of high hazard.
13. Mice may do serious damage any month of the year.
14. Heaviest populations not uniform but quite localized.
15. Infestations usually heaviest on upland sites.

In major part the mouse danger in horticulture arises from the limitation of diverse available feed sources so characteristic of the forest edge. Given a free choice of food, the mice feed on most any non-poisonous plant including trees. Once a sizeable tree root is injured from whatever cause, the resultant tender callus markedly raises the desirability of the tree as mouse feed. Trees—injured or not—are then potentially an ever present and continuing part of the mouse carrying capacity of the site even though the mouse load is divided between all suitable forage species present. Within limits, the larger the number of acceptable feed plant species that are present the smaller is the share carried by any one of them. With only one herb and one tree

species present, as in many farm, nursery or even home garden sites, the resultant heavy concentration by mice on the tree leads to disaster. With 10 or 20 kinds of herbs present the tree load is divided among the many species and is correspondingly much reduced. Some orchard trees are protected by 40 to 50 herbaceous plants. While the mice are basically grass feeders, the broadleaf plants, including hollies, furnish the diet diversity in cases not provided by herbs.

It becomes clear that proper utilization of natural damage control affords a sound adjunct to rodenticidal control. In all cases, the real objective is not mouse kill but *damage control*.

As sources to augment the tree-supplied feed, Tables 1 and 2 depict certain types of plant species as true sources of forage. Some, like the "muley grass," are highly desirable in the mouse range for the precise reason that they are rejected by agronomic agriculture. The feed value lies in the tough surface-growing rhizomes that continuously provide material for caches and produce excellent mouse feed. Attacks are diverted away from the trees all of the year during seasons good and bad. Unfortunately many of the listed herbs are condemned by growers as "weeds" and considered worthless because no one has previously found an economic need for them. Most broad-leaf herbs are seldom in dense stands and in too many permanent tree plantings are crowded out by the more highly dominant perennial grasses. Differential herbicidal treatments are now being studied to tip the balance as required in favor of either of the two desirable types—broad-leaf herbs and selected grasses.

It must be emphasized that, *alone*, even the richest flora of ground herbs will not prevent loss and may be associated with even a considerable and unacceptable loss of horticulturally grown trees. As previously stated some trees present must furnish a portion, however small, of the feed base for all members of the mouse colony. With increasing mouse numbers, the drain on the tree increases gradually to

some maximum permissible limit beyond which tree injury or kill becomes evident. Under this permissive limit of residual mouse number, a suitable list of herbs adequately protect the tree. With greater mouse numbers, rodenticidal action is required to reduce mouse numbers to manageable levels. Obviously an adequate feed base is fully effective when coordinated with an efficient rodenticidal operation—a two-phase damage control. (*Editor's Note:* Endrin was the chemical formerly used, but as of 1971, its use in New York State has been banned. The author recommends snap traps baited with apple for pine-mouse control on small properties [2 acres or under] where infestations are heavy).

Zinc Phosphide Baits

1. Use sound, firm apples, cut into pieces $\frac{1}{2}$ inch wide, $\frac{1}{2}$ inch thick, and $1\frac{1}{4}$ inches long.
 2. Place 1 qt. of the cut bait in an enameled pan.
 3. Sift level teaspoonful of the zinc phosphide powder over cut bait. Shake with rolling motion until all pieces are evenly covered with the dark colored stain of the phosphide.
 4. Mix fresh bait each day.
- Use caution in handling zinc phosphide.

In placing baits, go up one side of the row and come back down the other side.

Other suggestions:

1. Place poisoned bait in active trails or breather holes.
 2. Make 3 to 4 placings for each tree space just under the spread of the branches in the tree row and in undisturbed spaces down the lines of trees.
 3. Make placings in active spots where trees are missing.
 4. Make placings along fence rows and brushy areas, putting out the bait every 20 feet, in breather holes and feeding sites. After putting the poisoned bait in these places, cover with grass or other cover.
 5. Place 2 pieces of cut apple bait and $\frac{1}{2}$ teaspoonful of grain bait in each spot.
- (Continued)

TABLE 1. Effect of Herbs as Protective Alternate Feeds to Reduce Tree Root Injury

PROTECTIVE HERBS AS SINGLE ALTERNATE FEEDS		
Choice alternates	Apple roots vs. dandelion leaves	14% apple root
	{ vs. white clover	22% apple root
	{ vs. grass rhizomes	25% apple root
	{ vs. broad-leaf plantain leaves	25% apple root
	{ vs. dandelion roots	30% apple root
	{ vs. narrow-leaf plantain leaves	35% apple root
	{ vs. chickweed* (winter annual)	67% apple root
Less effective alternates	{ vs. pigweed (<i>Amaranthus retroflexus</i>)	71% apple root
	{ vs. field sorrel (<i>Rumex acetosella</i>)	75% apple root
	{ vs. Japanese honeysuckle stems	79% apple root
	{ vs. veronica	86% apple root

* Highly desirable because it is a winter annual.

PROTECTIVE CUMULATIVE EFFECT OF SEVERAL ALTERNATE HERBS

Apple roots vs.

Dandelion leaves plus grass rhizomes	7.5% apple root
Dandelion leaves plus grass rhizomes plus white clover	10.7% apple root
Dandelion root plus chickweed	11.0% apple root
Plantain leaves plus chickweed plus wild carrot roots	14.0% apple root
Plantain leaves plus grass rhizomes plus chickweed	15.0% apple root

TABLE 2. Highly Acceptable Herbs as Mouse Feeds

Common Name	Botanical Name	Feed Parts	In Caches
Dandelion	<i>Taraxacum officinale</i>	Leaf and root	Roots
White clover	<i>Trifolium repens</i>	Stolons & leaf	Stolons
"Muley" grass	<i>Muhlenbergia frondosa</i>	Rhizomes	Rhizomes
Broad-leaf plantain	<i>Plantago major</i>	Crown & leaf	
Narrow-leaf plantain	<i>Plantago lanceolata</i>	Crown & leaf	
Timothy	<i>Phleum pratense</i>	"Corms"	
Path knotweed	<i>Polygonum</i>	Leaf & stem	
Wild carrot	<i>Daucus carota</i>	Root	
Wood sage	<i>Teucrium canadense</i>	Root	Roots
Chickweed	<i>Stellaria</i>	Leaf & stem	
Orchard grass	<i>Dactylis glomerata</i>	Stem bases	
Five finger	<i>Cinquefoil</i>	Crowns	
Dryland grass	<i>Barbarea verna</i>	Leaf & root	



Gardeners in the Ecological Crisis

Fred C. Galle

Condensed from FLOWER AND GARDEN, January 1971

IN the last year the public has been bombarded with problems of the environment. We gardeners have always had concern for our environment, but now we too are faced with new words and ideas—"ecology," "microcosm," "ecosystem," "biodegradable."

Each of us in his own way has worked with plants, and perhaps even silently "thanked" plants every day, but we must do more than this. We must become involved with more than just our own gardens. We must reach out to the whole community and the nation to see that principles of conservation we have long followed are now carried beyond our garden fences.

There are many sounds of alarm today but most scientists agree there is time to bring problems under control. Fortunately the earth has a great capacity for self-repair, if we allow it to work. The most important and necessary step has already been taken by recognizing that the problem is real.

Many of us who deal with plants know that some serve as excellent detectors of air pollution, showing visible effects before other evidence may be noted. For example, tomatoes, peppers, and petunias give warning signals of unclean air—if

we learn to distinguish them from signs of neglect, disease, overfeeding or other growing troubles.

We also know plants play an important role as oxygenators of air and water, although there is not yet enough scientific data to cite their actual value in this respect. And we know they function to control erosion on banks and areas leading into streams. But the major role of plants in our communities, we are sure, is their esthetic one, and here they are of prime importance. We should continue to stress this role for plants.

Something more that gardeners know but seldom convey to others is the inspirational value and pleasure inherent in gardens, parks, and green spaces. We know that there must be gardens and greenery in our cities to balance the concrete and macadam, but we need to convince others of this need. People, cars and buildings crowded together can stifle the human spirit.

Farmers and gardeners at present are being "exposed" for their use of chemical fertilizers and resistant pesticides. We know, and should persuade others, that without fertilizers and pest controls we would be a hungry nation. We know too that the major problems come from

overuse and misuse of these chemicals. Let us hope that concern for our environment will make everyone more aware of his responsibilities in using chemicals wisely.

Waste disposal, another major concern, may yield partially to the old gardening theory of re-use. Most of us practice this in our composting and mulching. Water, paper, litter and many other wastes likewise can be, and in the future will be, reused to help "keep America beautiful." Let us encourage industry and science to work with us to reduce water and air pollution through better products and good control of wastes.

We can help improve the quality of

water in streams by using—and urging others to use—only detergents that reduce the buildup of phosphorus in waterways.

We need to stress zoning and litter laws throughout our country. Litter prevention particularly needs to be impressed on our youth, who are deeply involved with environmental problems but many times are the greatest offenders with regard to litter.

The goal should be a stable balance between civilization of our environment—not a balance of nature—for nature is always changing. Instead, we need a harmony of society and environment within the natural laws of physics, chemistry and biology. ♦

WHAT CAN GARDENERS DO?

- Join and actively support local, state and national organizations interested in environment. Encourage your local and state garden clubs to take an active part.
- Support community and state zoning designed to insure open space and landscapes free of congestion and ugliness.
- Study community and state laws to compare anti-pollution measures with national standards. See if there is a strong Water Quality Board with funds and power to enforce regulations. Work with local and state legislators to make them aware of environmental needs and to improve legal safeguards.
- Guide young people in their search for true facts and ideas. Encourage introduction of courses in ecology, conservation and horticulture in public schools and universities.
- Inspect and evaluate the water treatment and waste disposal systems of your local districts and industries.
- Encourage the study and development of an ecological inventory of cities and states to consider the total impact of man, his domestic animals and his industrial output on the carrying capacity of the environment.

WANT TO GET INVOLVED?

The following major national conser-

vation organizations are open to your participation and support. Write each individually for further information about membership, activities and areas of action.

The National Wildlife Federation
1412 16th St. N.W.
Washington, D.C. 22036

National Audubon Society
1130 Fifth Ave.
New York, N.Y. 10028

The Nature Conservancy
1522 K Street N.W.
Washington, D.C. 20005

The Wilderness Society
729 15th St. N.W.
Washington, D.C. 20005

The American Horticultural Society
2401 Calvert St. N.W.
Washington, D.C. 20008

Izaak Walton League of America
1326 Waukegan Rd.
Glenview, Ill. 60025

National Parks Association
1701 18th St. N.W.
Washington, D.C. 20009

Sierra Club
1050 Mills Tower
San Francisco, Calif. 94104

Hunting for Better Paw Paws

Reprinted from the 60TH ANNUAL REPORT OF THE NORTHERN NUT GROWERS ASSOCIATION (1969)

Corwin Davis

I HAVE BEEN interested in the paw paw (*Asimina triloba*) for quite a few years and every fall spend considerable time searching for new clones. The first found was 'Davis' and then for five years nothing more was found worthy of propagation.

It was over a year ago that Jane Taylor, wife of Dr. Lee Taylor, extension horticulturist at Michigan State University, told me about a patch that had some fine specimens. Last fall the search began with the Taylor and Davis families participating.

The area was a cutover beech and maple woods, bisected by a small ravine which leads to the Grand River. Not too far in, a clone heavily loaded with clusters of fair-sized fruit was observed. One lay on the ground and had been sampled by a coon or possum. The writer tasted it and found it superior in flavor to 'Davis' by a small margin. The fruits were ripe and promptly harvested. Mrs. Taylor is a paw paw enthusiast and uses them in cookies and other pastries.

The youngsters went into another thicket and came out with some large fruit but still green. I made another trip a few days later to this thicket and found the fruit had ripened; some weighed 12 ounces. Further exploration turned up another clone having a cluster of five that together weighed three pounds.

Scion wood was procured and we hope to get these grafted and growing this spring. As these bushes are very old, scion wood fit to graft was difficult to obtain. If grafting is successful, wood in small quantities should be available in 1972.

Until officially named, these "finds" made with the Taylors will be designated Taylor #1, Taylor #2, and Taylor #3.

I have a half acre devoted to research in paw paws and here cross-pollination work has been done. It is hoped by crossing the best, something may develop superior to what we now have.

The range of the paw paw is rather extensive. It extends north from eastern Texas to a line south of Lake Michigan, then east to the Atlantic. While fairly common in its range, many people have never seen the trees. The paw paw is a thicket grower. The seedling, after three or four years' growth, sends out underground stolons. These in turn throw up shoots, and this process is repeated until some thickets cover a quarter acre of ground. In Michigan the paw paw is usually found as an understory grower in beech and maple timber, and in our best deep loamy soils.

The history of the paw paw is obscure, but originally it was subtropical. It belongs to the custard apple family. Its nearest relative is the chermoya found in Florida, Mexico and Central America. It is thought that the paw paw was brought north by the Aborigines who were pursued by fiercer tribes. After hunting for superior clones for several years, the writer has reason to assume this assumption may be true, as most patches examined are at the headlands of small ravines, and the seeds are unsuitable for transportation by animals or birds.

Paw paws are easily identified in the fall. They have large elliptical leaves that hang down and, when they color, they are a brilliant yellow which can be observed as far away as a quarter mile. The foliage has a disagreeable odor, especially when bruised or on misty mornings.

Specimens have been observed as tall as 25 feet in the woods; seldom do they exceed 6 inches in trunk diameter. The blossoms are maroon in color and appear

in late May and early June. The bark is grey and smooth, the wood brittle and weak. The fruit is bean-shaped and borne in clusters of from three to seven fruits somewhat resembling bananas in appearance. Hence, the name "Michigan bananas," "Ozark bananas," etc. The largest fruits found have weighed 6 ounces. Any paw paw fruit over 8 ounces is large.

There are two general types of fruit: one with yellow flesh and one with greenish-white flesh. In all my exploring I have never tasted a greenish-fleshed fruit that was good. All named varieties have yellow or custard-colored flesh. The seeds are dark brown and numerous; and about the size of small lima beans. They taste ter-

rible and no rodent will bother to eat them.

The paw paw transplants with about the same results as walnut and hickory: all require close attention to watering the first year and vigorous pruning. If the tree is dug properly and care given the first summer, no difficulty should be encountered.

No insects bother the trees and spraying is unnecessary and undesirable. Malathion will kill them. They prefer deep rich soil. Grown in the open they form a pyramid-shaped tree, ideal for yard planting as an ornamental.

There are a few selected varieties but only one, 'Davis,' is on the market. It stands temperatures to twenty-five below zero. ♦



Brooklyn Botanic Garden

Left: Fruit and foliage of the paw paw. Above: Detail showing the flowers of the paw paw.

RECENT BOOKS WORTH NOTING

Listed alphabetically by author

Botany: a Golden Science Guide by Taylor Alexander, R. Will Burnett and Herbert S. Zim. Golden Press, New York. Illustrated in color. 160 pages. \$1.20.

A helpful little guide for the reader who wants a brief popular-level introduction to the science of botany.

The Complete Book of Groundcovers: Lawns You Don't Have to Mow by Robert E. Atkinson. David McKay Company, Inc., New York. Illustrated. 210 pages. \$7.95.

Some 450 kinds. Bank covers, ornamental grasses, succulents and ferns are included. One chapter is devoted to colorful foliage plants. There is also a list of seed and nursery sources.

Bamboo by Robert Austin and Koichiro Ueda. Walker/Weatherhill, New York & Tokyo. Illustrated with color and black and white photographs by Dana Levy. 215 pages. \$15.00.

Coffee table volume with 162 pages of superb photographs of bamboo and its artistic as well as utilitarian products. There are short chapters on bamboo lore, versatility, growth and cultivation.

Gardening Do's and Dont's by Samm Sinclair Baker. Funk & Wagnalls, New York. Illustrated. 312 pages. \$8.95.

Seasoned gardeners may feel that the 'nays' weigh heavily against the 'yeas'.

Bulbs for Summer Bloom by John Philip Baumgardt. Hawthorn Books, Inc., New York. Illustrated with photographs, some in color, and drawings by Kathleen Bourke. 232 pages. \$8.95.

All about dahlias, tuberous begonias, gladioli, lilies—and many less well-known bulbs, corms and tubers.

Gardens in Glass Containers by Robert C. Baur. Hearthside Press, Inc., New York. Illustrated in color and black and white. 191 pages. \$6.95.

Terrariums, apothecary jars, brandy sniffers and the like. Making one's own containers. Plants for the terrarium. Sources of supply.

Trees and Shrubs Hardy in the British Isles by W. J. Bean. Vol. I, A-C. 8th

edition fully revised. John Murray, London, England. Illustrated with drawings and photographs. 845 pages. \$19.20 (£8).

The first part of an extensive revision of a standard British reference (original publication date, 1914). There are new chapters on taxonomy and nomenclature as well as a revised section on cultivation. Bean still shines through, for he had firm opinions—as well as a seemingly encyclopedic knowledge—about woody plants. But Desmond Clarke, who did much of the detailed revision, has skillfully and unobtrusively brought the work up to date. While intended for British readers, it provides background information that will be of interest to North American horticulturists who work with uncommon plants. Three more volumes to come.

The Cacti of Arizona by Lyman Benson. 3rd edition revised. University of Arizona Press, Tucson, Arizona. Illustrated with color and black and white photographs; drawings. 218 pages. \$6.95.

Taxonomic study of one of the Southwest's most prominent plant families. Of interest to the cactophile as well as the botanist. For this edition Dr. Benson, professor of botany at Pomona College in California, has provided an almost wholly new text.

Dr. Alexander Garden of Charles Town by Edmund and Dorothy Smith Berkeley. The University of North Carolina Press, Chapel Hill. Illustrated with drawings. 379 pages. \$10.00.

A scholarly biography of the Scotsman who practiced medicine in pre-revolutionary Charleston, South Carolina, and hunted for plants in his spare time. One of the odd facts the Berkeleys have uncovered is that Garden's name was very nearly commemorated in a little *Hypericum* instead of the beautiful evergreen shrub that mild-climate gardeners the world over have come to love—the gardenia.

Bouquets That Last by Emily Brown. Hearthside Press, Inc., New York. Illustrated with color photographs and drawings. 175 pages. \$10.00.

A helpful guide for those who want to keep the arrangements they make. There is an extensive list of suitable plants.

Great Gardens of America edited by Carroll C. Calkins. Coward-McCann, Inc. New York & Country Beautiful, Waukeasha, Wisconsin. Illustrated with 60 plates in full color and many photographs in black and white. 298 pages. \$22.50.

A coffee-table volume devoted to 38 gardens. Relatively few of the major institutional gardens are covered, but there is useful information on some of the less well-known ones.

Creative Ways With Flowers: the Best of Two Worlds—East and West by Rachel E. Carr. Doubleday & Company, Inc., Garden City, New York. Illustrated with color and black and white photographs. 95 pages. \$6.95.

Flower, leaf and twig arrangements with instructions. The influence of Japanese design is strong.

The Plant Hunters by Alice M. Coats. McGraw-Hill Book Company, New York. Illustrated. 400 pages. \$10.95.

A delightful and well-researched history, from the Renaissance to modern times. Many fascinating, little-known tales of brave men and their horticultural bounty. It is unfortunate that this and Tyler Whittle's book, both written by English authors and published in the same year, bear identical titles.

Woody Plant Source List by T. J. Cole and L. C. Sherk. Ornamental Plant Section, Plant Research Institute, Canada Department of Agriculture, Ottawa, Canada. 88 pages (mimeographed).

A most useful nursery source guide, intended for Canadians who work with plants. While no plant descriptions are included, a large number of uncommon trees, shrubs and vines are covered. (Available without charge from Information Div., Canada Dept. of Agriculture, Ottawa, Ontario, KIA 0C7, Canada.)

The Complete Book of Flower Preservation by Geneal Condon. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. Illustrated with color and black and white photographs. 210 pages. \$7.95.

Some of the techniques used in this popular hobby.

Gardening for Fragrance, Indoors and Out by Nelson Coon. Hearthside Press, Inc., New York. Illustrated. 239 pages. \$5.95.

A relaxed, rather personalized account. The author has had many years of experience in growing plants with fragrant

flowers or aromatic leaves. Plant lists. Bibliography. Originally published (1967) as *Fragrance and Fragrant Plants for House and Garden*.

Making Gifts from Oddments & Outdoor Materials by Betsey B. Creekmore. Hearthside Press, Inc., New York. Illustrated with photographs in color and black and white; drawings. 224 pages. \$7.95.

Imaginative uses for plant parts. "Glass," waxed and pressed flowers, as well as pomanders and sachets, are among the subjects discussed.

Rhododendrons and Azaleas edited by Philip Edinger. A Sunset Book. Lane Books, Menlo Park, California. Illustrated with color and black and white photographs; line drawings. 80 pages. \$1.95.

Introduction to a popular group of plants which, like other Sunset gardening books, is well illustrated. Of special appeal for West Coast gardeners who desire a broad-spectrum treatment.

John Banister and His Natural History of Virginia, 1678-1692 by Joseph and Nesta Ewan. University of Illinois Press, Urbana, Illinois. 485 pages. \$15.00.

This scholarly account of an early plant explorer is followed by his catalogs and other writings. Extensive references. For the specialist.

West Australian Native Plants in Cultivation by A. R. Fairall. Pergamon Press, Ltd., Australia. (Pergamon Press, Inc., Fairview Park, Elmsford, N.Y. 10523). Illustrated with color photographs. 253 pages. \$10.50.

Descriptions and cultural information on some 650 species. A rather small number of the plants mentioned are familiar to American gardens, but this posthumous work which has many fine photographs, may serve as an idea book for mild-climate gardeners (particularly Californians) in search of uncommon ornamental plants.

The Flowering World of "Chinese" Wilson edited by Daniel J. Foley. The Macmillan Company, New York. Illustrated with black and white photographs. 334 pages. \$8.95.

Probably no plant hunter captured the imagination of the public as did Ernest H. "Chinese" Wilson (1876-1930) who as an explorer for Veitch's Nursery in England and later for the Arnold Arboretum, intro-

duced to cultivation the regal lily, Kurume azalea and beauty-bush (*Kolkwitzia*). Mr. Foley has selected some of the most vivid writings of this extraordinary explorer and has written a brief biography.

Keeping the Plants You Pick by Laura Louise Foster. Thomas Y. Crowell Company, New York. Illustrated by the author. 150 pages. \$4.95.

A delightful how-to book on a craft that has a growing appeal for many people. Mrs. Foster explains techniques clearly and concisely, and her drawings are a joy.

The Gardener's Book of Arrangements by Helen Snow Wilson Goddard. The Macmillan Company, New York. Illustrated with black and white photographs; drawings. 192 pages. \$5.95.

Designs according to the seasons. Dried pods, berries, even fruits and vegetables, along with flowers and leaves.

Exotic Plant Manual by Alfred Byrd Graf. Roehrs Company, East Rutherford, New Jersey. 4,200 illustrations with pictograph keys to plant care, plant geography and ecology. 840 pages. \$27.50.

A "mini" *Exotica* with illustrations of greenhouse and other mild-climate plants. Descriptions, cultural keys. An eminently useful reference for the owner of a small commercial or home greenhouse.

Exotica 3. Pictorial Cyclopedia of Exotic Plants; Guide to Care of Plants Indoors by Alfred Byrd Graf. Century edition. Roehrs Company, East Rutherford, New Jersey. Illustrated; 204 plants in color. Horticultural color guide. 1,834 pages. \$60.00.

The same prodigious tome as the earlier *Exotica 3* but including nomenclatural revisions and amended photographs. Plant descriptions, cultural keys and 12,000 illustrations. Indispensable for those who work with greenhouse plants. A labor of love on the part of the peripatetic Mr. Graf, who is now busily preparing *Exotica 4*.

Tree Trails in Central Park by M. M. Graff. Greensward Foundation, Inc., New York. Illustrated with line drawings by Jacques Hnizdovsky. Map. 189 pages. \$3.95.

New Yorkers with a general or special interest in the more-or-less natural world around them will be heartened by this series of eleven tree tours in the City's best-known park. Some 118 kinds of trees and shrubs are described, including such unfamiliar im-

migrants to the Manhattan scene as the painted maple (*Acer mono*), golden-larch (*Pseudolarix amabilis*) and Korean pine (*Pinus koraiensis*).

The Oxford Book of Wild Flowers by S. Ary and M. Gregory. Pocket edition. Oxford University Press, New York. Illustrated in color and black and white by B. E. Nicholson. 222 pages. \$4.00.

A handy pocket book for the plant-minded traveler in the British countryside. Take along a magnifying glass in the other pocket, since the print is uncommonly small.

Home Guide to Trees, Shrubs and Wildflowers by William Carey Grimm. Stackpole Books, Harrisburg, Pennsylvania. Illustrated with black and white drawings. 320 pages. \$9.95.

A well-illustrated book devoted to the native plants of the eastern U. S. Useful for identification purposes. The title may prove misleading to homeowners seeking information on garden plants and how to grow them.

Handbook of Hollies: a special issue of The American Horticultural Magazine on *Ilex*. Vol. 19, No. 4. Edited by Dorothy Ebel Hansell. The American Horticultural Society, Inc., Washington, D. C. Illustrated with black and white photographs, line drawings. 334 pages. \$5.50.

A timely revision of the 1957 edition, expanded to include information about new cultivars and uncommon species. Articles by 30 contributors on various kinds of hollies, landscape uses, culture, propagation, orcharding and pests. Although there are numerous photographs, readers owning the earlier Handbook may want to keep it for some of the individual leaf sketches that are not included in the current edition.

The How to Grow and Cook It Book of Vegetables, Herbs, Fruits and Nuts by Jaqueline Hériteau. Hawthorn Books, Inc., New York. Illustrated. 299 pages. \$7.95.

A "two-in-one" treatment. The kitchen is more prominent than the garden.

Enjoying Your Garden by Michael Jefferson-Brown. John Gifford Ltd., London. Illustrated. 190 pages. \$4.25.

Basically, some of the author's favorite plants.

Small Garden Design by Michael Jefferson-Brown. John Gifford Ltd., London. Illustrated with photographs, some in color, and drawings. 210 pages. \$5.75.

(Continued)

Account by an English gardener who mentions a number of plants for the small garden. Some of them are commonly available in the U. S., others are not.

Ikebana Everlastings: Dried-flower Arrangements by Mami Kawasaki. Translated by Yuriko Hayashi and Robert Engler. Japan Publications, Inc., Tokyo. Photographs in color and black and white by Tokokazu Imai; drawings. 61 pages. \$4.25.

Extensively illustrated book on dried-flower arrangements with much how-to information.

The Home Garden Cookbook: From Seed to Plate by Ken and Pat Kraft. Doubleday & Company, Inc., Garden City, New York. Illustrated with color photographs. 297 pages. \$6.95.

Vegetable growing and recipes. Fruit and nut trees. Brief list of sources.

The Gardens in My Life by Mabel Barbee Lee. Doubleday & Company, Inc., Garden City, New York. Illustrated. 144 pages. \$4.95.

A nostalgic collection of memoirs, illustrated with charming drawings by Karl Swanson.

Gardens, Plants and Man by Carlton B. Lees. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. Illustrated. 251 pages. \$19.95.

A handsome volume, lavishly illustrated with good black and white and color photographs. An unusually humane account, also a pleasing abstraction of great gardens of the past.

Vegetable Dyeing by Alma Lesch. Watson-Guptil Publications, New York. Color charts. 144 pages. \$7.95.

Many (151) recipes for dyeing yarns and fabrics with natural materials.

Garden Ideas A to Z by Elvin McDonald. Doubleday & Company, Inc., Garden City, New York. Illustrated with photographs, 70 in color 196 pages. \$7.95.

Many attractive photographs soften a rather awkward format. Includes a list of suppliers of plants, seeds, bulbs and gardening equipment.

Gardens of Europe: A Pictorial Tour. Text by Dorothy Loa McFadden, photographs by James L. and Dorothy Loa McFadden. A. S. Barnes & Company, Inc., Cranbury, New Jersey. 198 pages. \$25.00.

Fundamentally an armchair photographic journey to Europe's well-known (and not so well-known) gardens.

Design With Nature by Ian L. McHarg. The Natural History Press, Garden City, New York. Illustrated with black and white photographs; geological and other maps in color. 198 pages. \$19.95.

An overview of landscape design and ecology, written by a master planner who is Chairman of the Department of Landscape Architecture and Regional Planning at the University of Pennsylvania. Of particular importance for public officials and those who are responsible for large-scale design.

Flowering Vines of the World: An Encyclopedia of Climbing Plants by Edwin A. Menninger and 50 collaborators. Hearthsides Press, Inc., New York. Illustrated with color and black and white photographs. 410 pages. \$25.00.

A splendid reference, of greatest interest to gardeners in mild climates, since many of the plants mentioned require frost-free conditions. There are descriptions of a vast range of uncommon vines.

Flowering Plants: Flowering Rush to Rushes by Robert H. Mohlenbrock. Southern Illinois University Press, Carbondale, Illinois. Illustrated with black and white drawings. 272 pages. \$10.00.

A scholarly treatment, with botanical descriptions and keys of Illinois pondweeds, duckweeds, flowering rushes, arrowheads, cattails and spiderworts. Volume I of the *Illustrated Flora of Illinois*.

Flowering Plants: Lilies to Orchids by Robert H. Mohlenbrock. Southern Illinois University Press, Carbondale, Illinois. Illustrated with black and white drawings. 288 pages. \$10.00.

Companion volume to the preceding. Besides lilies and orchids, iris and cat-briers (*Smilax*) are given botanical attention. Volume II of the *Illustrated Flora of Illinois*.

Wild Flowers of the World by Brian D. Morley. G. P. Putnam's Sons, New York. Illustrated with paintings by Barbara Everard. 432 pages. \$15.00.

More than 1,000 plants are shown on 19 full-page color plates in this beautiful authoritative volume. There are also maps showing distribution of the plants, which are grouped in 12 geographic regions—from the Arctic to tropical Africa, from North America to the Himalayas and Australia. Index of common and botanic names are helpful.

guides.

The Lazy Gardener's Garden Book by William Morwood. Doubleday & Company, Garden City, New York. Illustrated by Sharon Landa. 200 pages. \$5.95.

A somewhat breezy account of basic gardening techniques.

Guide to New Approaches to Financing Parks and Recreation, compiled by the National Recreation and Park Association, edited by Robert M. Artz and Hubert Bermond. Acropolis Books, Washington, D. C. Illustrated with black and white photographs. 126 pages. \$5.95.

There are still ways to obtain funds for new parks, and this short book explains some of them. Several of the approaches are relatively new, others are not.

The Ingenious Kingdom: the Remarkable World of Plants by Henry and Rebecca Northen. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. Illustrated with black and white photographs, line drawings. 274 pages. \$8.95.

A popular, well-written account. From algae to flowering plants—and more. Enjoyable armchair reading.

Diseases and Pests of Ornamental Plants by Pascal P. Pirone. 4th edition. Ronald Press Company, New York. Illustrated. 546 pages. \$12.00.

A welcome revision of a standard reference. Especially pertinent for professional horticulturists. New plagues, new treatments. Expanded coverage of fungicides, bactericides and miticides. Specific recommendations of DDT have been dropped from this edition, and where choice has permitted, the pesticides least toxic to people, animals and fish have been recommended. The author is senior plant pathologist at the New York Botanical Garden.

Enjoying Our Trees. Articles from *American Forests Magazine* selected and edited by Charles Edgar Randall. The American Forest Association, Washington, D. C. Illustrated with black and white photographs. 122 pages. \$6.00. (1969)

Each article is devoted to a well-known American tree. Uses of various woods, tree descriptions and lore are included. The background information complements an earlier American Forestry Association book, *Knowing Your Trees* (revised edition, 1965).

Wild Flowers of the United States: The Southwestern States. Volume 4, in 3 parts, by Harold William Rickett. Illustrated with color photographs and black and white drawings. 801 pages. \$52.50.

The latest in a lengthy series from the energetic pen of the senior curator of botany at the New York Botanical Garden. Plant descriptions are intelligible to the layman and the numerous photographs are generally of a high rank. This "volume," devoted to the wild flowers of southern California, Arizona and New Mexico, actually consists of three oversized books.

The Basic Book of Organic Gardening edited by Robert Rodale. Rodale Press, Inc., Emmaus, Pennsylvania. 377 pages. \$1.25 (paperback).

A reference for those interested in growing plants organically. Based on material which has appeared in *Organic Gardening Magazine*.

Modern Roses 7: The International Checklist of Roses compiled by the International Registration Authority for Roses, The American Rose Society, The McFarland Company. Preface by R. C. Allen. The MacFarland Company, Harrisburg, Pennsylvania. Illustrated with color and black and white photographs. 472 pages. \$14.95.

An important reference for those who frequently work with roses. Brief descriptions of countless varieties.

The Rose Annual 1970 edited by Leonard Hollis. Published by the Royal National Rose Society, England. Illustrated with color and black and white photographs. 240 pages. \$2.25.

A series of short articles on new and not-so-new roses, as well as other notes of interest to the hobbyist. It will not come as a surprise to American rosarians that many of the varieties mentioned in this English book are either little known or not cultivated here at all.

Gardening with Ease: A Minimum Maintenance Manual by Stanley Schuler. The Macmillan Company, New York. Illustrated. 308 pages. \$6.95.
Tips on garden housekeeping.

Plant Agriculture: Readings from Scientific American selected by Jules Janick, Robert W. Schery, Frank W. Woods & Vernon W. Ruttan. W. H. Freeman & Company, San Francisco, California. Illustrated in color and black and white.

(Continued)

246 pages. \$10.00.

The 25 articles in this collection relate to the plants that sustain man in his environment.

A Treasury of American Indian Herbs by Virginia Scully. Crown Publishers, Inc., New York. Illustrated. 306 pages. \$6.95.

Lore as well as culinary and medicinal uses of a fairly wide range of plants employed by Indians of the Rocky Mountain region. A bibliography is included.

The Poetry of Leaves by Norman Sparron. (Creative Ideas for Japanese Flower Arrangement Series.) Walker-Weatherhill, New York and Tokyo. Illustrated with color photographs by Miki Takagi; black and white by the author. 190 pages. \$8.95.

A series of striking photographs of Japanese "flower" — actually leaf — arrangements, based on classical Ikebana and modern Sogetsu principles, and created by the author. Brief explanations accompany each arrangement. Readers who associate aspidistra with the friendly neighborhood tavern are in for a surprise, since the author employs this plant most tastefully in 23 designs.

Diseases of the Cultivated Plants of the Southwest by Rubert Burley Streets, Sr. University of Arizona Press, Tucson, Arizona. Illustrated with black and white photographs. 390 pages. \$9.50. (1969)

Keen gardeners and professional plantmen from southern California to Texas will especially welcome this serviceable volume. Besides ornamental plants, including cacti, the author treats vegetables and field crops. There is a special section on the effect a semiarid environment has on plant diseases. Dr. Streets is professor emeritus of plant pathology at the University of Arizona.

Charles Sprague Sargent and the Arnold Arboretum by S. B. Sutton. Harvard University Press, Cambridge, Massachusetts. Illustrated. 382 pages. \$10.00.

The story of a very proper Bostonian who founded and oversaw for 55 years (1873-1927) the development of one of America's leading arboreta. Not a "warts and all" biography, for Sargent had few warts, but an enlightening description of behind-the-scene botany at Harvard in the latter years of the 19th century. There are frequent references to John Muir, Asa Gray and George Engelmann, and an interesting

section on the travels of noted plant collectors Ernest H. Wilson and Joseph Rock.

Contours of Change edited by Jack Hayes. USDA Yearbook 1970. Foreword by Clifford M. Hardin, Secretary of Agriculture. United States Government Printing Office, Washington, D. C. Illustrated in color and black and white. 366 pages. \$3.50.

Sections on America's agricultural revolution, the changing social and administrative structure of rural areas, America's role in world agriculture, and a look at tomorrow.

Selected Weeds of the United States. U. S. Department of Agriculture Handbook No. 366. U.S. Government Printing Office, Washington, D. C. Illustrated. 463 pages. \$4.00.

A thick, soft-cover volume with large drawings of 224 weeds. There are maps showing the range of each weed as well as botanical descriptions. Glossary of botanical terms. A handy reference book.

Trees, Shrubs and Vines: a Pictorial Guide to the Ornamental Woody Plants of the Northern United States, Exclusive of Conifers by Arthur T. Vierter. Syracuse University Press, Syracuse, New York. Illustrated with fine drawings. 170 pages \$2.95.

Essentially the same as the 1961 revised edition, but with a new hardiness zone map (USDA) for the northeastern quadrant of the U.S. and adjacent parts of Canada. The soft-cover book is worth special note because of its usefulness to homeowners puzzled by unknown woody plants in their areas. The main part of the book is devoted to some 600 leaf drawings which represent most of the species likely to be encountered in northern gardens. A separate section lists brief descriptions of these trees and shrubs. There are no detailed keys, but the book is clear and well organized.

Plant Disease Handbook by Cynthia W. Cott. Revised 3rd edition. Van Nostrand Reinhold Company, New York. Illustrated. 843 pages. \$19.95. (1971)

Updating of an often-consulted book by one of America's leading "plant doctors." New diseases, new remedies—and the recent pesticide controversy—have been considered in the revision.

In Praise of Roses by Harry Wheatcraft. Henry Regnery Company, Chicago, Illinois. Illustrated with color and black and white photographs. 192 pages. \$12.50.

Relaxed but very informative account by one of England's well-known growers. Some history of roses is included, as well as a selected list of roses.

The Plant Hunters by Tyler Whittle. Chilton Book Company, Philadelphia, Pennsylvania. Illustrated with black and white photographs. 281 pages. \$8.95.

A lively, fast-moving account of the legendary figures who introduced many beautiful plants to the western world from far-off lands. Good bedside reading.

The Growing Tree by B. F. Wilson. The University of Massachusetts Press, Amherst. Illustrated with drawings. 152 pages. \$6.50.

A refreshing, well conceived and not overly technical treatment of what is actually a rather complex subject—the process of tree growth. It may have special appeal for the backyard dendrologist as well as for the college student.

African-Violet Book by Helen Van Pelt Wilson. Revised edition. Hawthorn Books, Inc., New York. Illustrated. 238 pages. \$7.95.

Kinds, culture, propagation and pests of one of America's most popular house plants.

Wyman's Gardening Encyclopedia by Donald Wyman. The Macmillan Company, New York. Illustrated with color and black and white photographs; drawings. 1,222 pages. \$17.50. (1971)

A most useful single-volume encyclopedia compiled by the horticulturist emeritus of the Arnold Arboretum. While Dr. Wyman wrote most of the text, there are special-subject contributions by 23 authors. Especially helpful: propagation notes on many uncommon plants. Unusual features: herbaceous perennials as well as trees and shrubs are given hardiness zones. (Gardeners might bear in mind that such attributions are by nature approximate, since a lengthy winter snow cover, acting as an insulant, will result in some perennials thriving in climates where they would not normally survive.) The book

will likely be a standard reference for some years to come.

Ground Cover Plants by Donald Wyman. 5th printing. The Macmillan Company, New York. Illustrated. 175 pages. \$5.95.

New edition of a book that has been out-of-print for some time (original publication date, 1956). Ground covers for special purposes.

Soft-cover reprints by Dover Publications, New York.

Gardening With Herbs for Flavor and Fragrance by Helen Morgenthau Fox. Illustrated. 326 pages. \$2.50.

Unabridged reprint of a book published in 1933. Several generations of gardeners have benefited from Mrs. Fox's advice.

Mushrooms of the Great Lakes Region by Verne Ovid Graham. Illustrated. 390 pages, 49 plates. \$4.50.

Botanical descriptions of 1,200 kinds. Keys. Unabridged reprint (1944).

The Vegetation of the New Jersey Pine-Barrens: an Ecologic Investigation by John W. Harshberger. Illustrated. 329 pages. \$3.50.

Reprint, unabridged, of an ecological botanist's study (1916) of one of the most intriguing floras of the Northeast. John McPhee's *The Pine Barrens* (Farrar, Straus & Giroux, New York, \$4.50) serves as a fine complement to Harshberger's book.

Ferns of the Eastern Central States, with Special Reference to Tennessee by Jesse M. Shaver. Illustrated. 502 pages. \$4.00.

Unabridged republication of a 1954 book titled *Ferns of Tennessee*. Botanical descriptions of 63 species.

A Garden of Herbs by Eleanor Sinclair Rohde. 300 pages. \$2.50.

The 4th (1936) edition, unabridged. The British author deals with old-fashioned herbs and frequently refers to herbals for traditional uses. Recipes.



Hishaku—hand-carved bamboo water ladle. From: Bamboo by Robert Austin, published by Walker/Weatherhill, New York.

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Plastic Bags for Potting Small Trees

Reprinted from the 59TH ANNUAL REPORT of the
NORTHERN NUT GROWERS ASSOCIATION (1968)

It is often necessary to pot small seedling trees to hold them over the interval between the time they are dug from the seed bed until they are to be set out in a permanent location. If they are to stay in the pots until they are in full leaf, it is important that the pot may be removed at the time of planting without disturbing the ball of earth around the roots.

Clay pots are not deep enough, and metal containers, such as gallon oil cans, are not easily cut away without disturbing the contents. For the past two years I have used plastic bags for potting small trees. A number of seedling walnut, hickory, filbert, oak and ginkgo trees have been held over winter and into the second growing season and are still making excellent growth in these bags. When ready to set one of these trees out into its permanent location, it is only necessary to slit the plastic with a sharp knife and slip the unbroken ball of earth out of the plastic and into the hole in the ground.

The bags I have used are some in which bacteriologist's Petri dishes are packaged. The bags are of polyethylene, approximately 3 mils in thickness, and they open out to 4 inches in diameter and 15 inches deep. Holes must be punched near the bottom for drainage. I pot the trees in a sifted compost mixed with a little sand and some dried sewage sludge. The latter makes the mixture more free-flowing so that it can be poured in around the roots of the seedling, and can be settled by jiggling the bag and by watering. During the growing season the trees must be kept watered, and if they are kept in the bags over winter they should be well mulched to protect the roots from extreme temperatures.—E. M. Shelton

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